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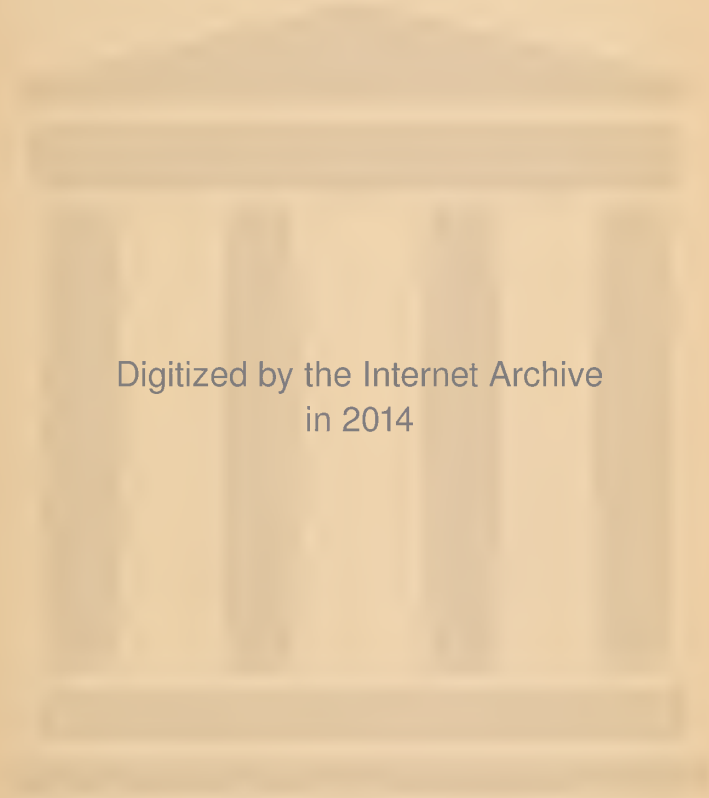

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American Public Health Association

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The "List of Members," and the "Sanitary Authorities of the United States, Canada, and Mexico," have been revised to date.

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I.

THE PRESIDENT'S ADDRESS.

By FREDERICK MONTIZAMBERT, M. D., EDIN.; F. R. C. S.; D. C. L.

MEDICAL SUPERINTENDENT CANADIAN QUARANTINE SERVICE,

Quebec, Canada.

Mr. Chairman, Members of the American Public Health Association—Ladies and Gentlemen: In the offering of his annual address to a public gathering such as this, the President of the American Public Health Association has, as it seems to me, a two-fold duty to fulfil. This follows naturally from the two-fold nature of his audience. He has, in the first place, to speak to those present who are strangers to the Association, and to endeavor to interest them by some account of its general scope and working. In the second place, it may well be expected, by the members of the Association itself, that some reference, however brief, should be made to the paths along which progress has been made since the last annual meeting, and some brief review given of the conclusions of scientific research and of experimental investigation on those subjects which affect them most closely.

"The objects of this Association shall be the advancement of sanitary science, and the promotion of organizations and measures for the practical application of public hygiene:" that is the definition of our constitution. An "acknowledged interest in or devotion to sanitary studies and allied sciences, and to the practical application of the same:" that is the qualification for the submission of a name for membership, and that alone.

This, then, is an association which is not confined, either in theory or in practice, to the medical profession. And this fact we are glad to take occasion from time to time to bring prominently before the public. Any one is welcome to our ranks who takes any practical and living interest in the grand objects of the prevention of disease and the raising of the standard of the people's health. And this, whether it be by the larger organizations of the nation, the state, and the community, or by the hygiene of the house and the home—that hygiene of the dwelling and of the individual which must be the foundation stone of all sanitary work, and which is of such paramount importance to the moral and physical well-being of the community.

Our meetings are held at different places from year to year, and in this way the Association has already been in touch with a large portion of the continent. Our coming is heralded, and our proceedings are fully reported

from day to day, by the newspapers of the district. Our hope is—and it is a hope amply justified by past experience—that the Association thus enlarges the sphere of its usefulness; that the hands are strengthened and borne up of those who are already fighting the battle for sanitary progress in that neighborhood; and that when the echoes of our deliberations fall on the ears of those who have heretofore neglected these matters, from thoughtlessness rather than from wilfulness, they may be warmed and stimulated into cordial sympathizers and earnest fellow-workers,—each head of a family, and each individual, becoming, in a measure, a sanitary officer for his immediate home and surroundings, and taking for the future an intelligent interest in the development of sanitary progress and reform in his city, village, or district.

Last year we met in a sea-coast city, and quarantine—the prevention of disease from without getting into the country—came prominently under consideration. This year we meet in an inland city, and the health organizations to prevent disease, and to deal with the disease that has got in, seem naturally to invite the greater attention.

These are the two main strings to the sanitary bow,—a system of maritime sanitation at the ports of entry, and a system of prevention and preparedness in the interior communities. Neither is sufficient without the other. The interior communities throughout the length and breadth of the continent have an interest, and a very close and vital interest, in the fittings and working of the quarantine service at the various ports. But confidence in a quarantine system, however perfected, must never be allowed to lull us into a false sense of security, to the neglect of striving ever more and more towards the sanitary improvement of the cities, villages, and districts in which we live.

From the long period of incubation of some of the infectious diseases and the relative shortness of the voyage from many ports outside the country, and from the possibility of disease lurking in imported clothing and effects, it is evident that, unless there could be a routine quarantine detention of all vessels arriving at every port and a routine disinfection of all clothing and merchandise from abroad, there is always the possibility of exotic disease passing the quarantine barriers in an invisible and unrecognizable stage and condition, and first declaring itself in the interior of the country. This cannot be avoided without such detention of vessels, passengers, and merchandise at the ports of arrival, and such consequent interference with trade and commerce, as would be quite unjustifiable and impracticable.

Quarantines may be held accountable for dealing with actual cases of infectious disease, with infected vessels and effects, and those suspected of being infected. In this way they strain out, and protect the country from, a very large percentage indeed of the exotic diseases which threaten it from time to time. But they must not be expected to do the impossible. Nor must they be leaned on as an excuse for lessened effort inland. Occasional cases of infectious disease in the stage of incubation, and the

micro-organisms of disease lurking in unsuspected clothing or merchandise, may pass from time to time the most efficient quarantine that is practically possible. An outbreak may thus occur in some inland locality. Then at once comes in the value of the national, the state, and the local boards of health, with an organized system of notification and isolation to limit, to confine, and to stamp out the disease.

Coast quarantines and inland health organizations form, then, our double line of defence; or, to borrow an illustration from the game of cricket, the coast quarantine is the wicket keeper, and the health board the long stop.

But it is not only with regard to the relatively infrequent advent of disease from abroad that the results of our inland health work is to be looked for. There are elements of disease, alas! always with us. And it is in the daily, hourly combat with these that the sanitary worker finds scope for his most earnest efforts.

To the medical men of this vicinity, the meeting here of this Association is meant in part as an appeal to quicken your interest in the more purely preventive work of our profession; to increase your interest in the organization and working of the coast quarantines and the health boards by which you are affected, the sewerage of your cities, the disposal of the garbage and refuse, the purity of the water-supply in each of your localities, the infectious diseases of animals now known to be closely related to those of men, and other such broader questions of modern sanitation.

To all the non-medical of all ages, sexes, and conditions, it is an appeal to take a lively and practical part in the great crusade against dirt and disease. As in times of invasion every loyal citizen is ready to take up arms in defence of the common liberty, so should every one make war against the common enemy of mankind which comes to attack the health. In the words of Sir Spencer Wells, "Instruct your mayor and corporation, your clergy of all denominations, your own household, that every case of typhoid fever, of scarlatina, of diptheria, of small-pox, measles, whooping-cough, can no longer be looked upon as natural, providential, or unavoidable; but that the existence of such preventable diseases is a proof of ignorance or negligence, and a disgrace to the country, to the town, to the family."

Disregard of the laws of health arises not so much from antagonistic views in relation to proper sanitation, as from our tendency to undervalue the homely little facts and little opportunities of every-day life. As has been well said, "If every individual in a city appreciated the fact that he is to some extent responsible for the condition of the public health, and, in order to keep his conscience clear, kept his back yard, cellar, alley, and street clean, the reports of the commissioner of public health would show the result of the multiplied effort."

Every one can do a little, if only to make one home, or one room, more bright, more cleanly, more wholesome. Sunlight, pure air, and thorough cleanliness are natural enemies of disease germs. These cannot live where they have not their proper food, which is found in dampness, dark-

ness, mould, and dirt. The experiments of Koch, Ransome, and others prove that the living germs of consumption, when exposed to the sunlight, lose their vitality in a few hours, or even in a few minutes, if the layer in which they are exposed be thin enough, and that even ordinary daylight, if it last long enough, will have a similar effect. There is no sounder philosophy than is to be found in the old sayings, "There is more health in a sunbeam than in drugs, more life in pure air than in the physician's skill;" that "Sunlight may fade your carpets, but better that than have disease fade your cheeks."

Every one can do a little, if it only be to say the helping word or do the helping act, towards some sanitary improvement, however small in itself. For indeed the aggregate of those little words and little acts may help to increase the health and happiness of your homes and communities more than you may well realize, both directly by their influence on your surroundings, and indirectly by their encouragement of those who are officially charged with your sanitary well-being.

For those gentlemen—unless this be an exceptionally favored community—must often feel how grateful a larger measure of public support would be, and how much a little more sympathy in their work, openly expressed, would cheer and stimulate them to renewed efforts for the public welfare.

Sanitary science is comparatively new, and the prevention of disease as an actuality is not yet fully impressed upon the public mind. There is a vast difference in the popular understanding between the curing of disease and its prevention. The one is actual, visible, comprehensible; the other vague, intangible, and not discernable by any of the senses. Man knows when he is sick, but he is unconscious of approaching disease, and of disease which has been averted, because he is unaware of the conditions that lead up to and produced his maladies. People are generally quick to tender warmest praise to the physician who has brought them safely through some awful illness, and very rightly. But quite as great skill is habitually being displayed throughout the country in the removal of the causes, and the prevention of the outbreak and spread, of disease. Yet how seldom, comparatively, is this recognized or appreciated.

Do not, then, on the one hand, withhold the kindly word of appreciation when occasion offers. And on the other hand, as a worker, be not discouraged if much of your best work seems to go unrecognized and unthought of. The greatest, many times the only, reward of the sanitarian is to be found in the consciousness of good work well done.

NECROLOGY.

There is a kindly usage which custom has established that bids me, amidst our pleasant strains of mutual greeting, sound in minor key the sadder note of regretful and feeling remembrance for those of our brotherhood whose faces we may no more hope to see on earth, whose voices will

be no more heard amongst us, who have been taken, since our last annual meeting, from earthly labor to eternal rest.

Dr. Hosmer Allen Johnson, of Chicago, died at his home in that city on the 26th of February last. For nearly forty years Dr. Johnson had been actively identified with every forward movement that commended itself to his warm, generous heart and his wide learning. He was president of this Association only two short years ago, presiding over it at the annual meeting in Brooklyn in 1889. He was with us, as most of you will remember, at our meeting last December at Charleston, South Carolina, and took part in our proceedings with apparently his usual vigorous interest. But he was even then in failing health, which resulted shortly afterwards in fatal heart decline.

Surgeon-General Alfred E. Holt, Cambridge, Mass.; Paul H. Kretzschmar, M. D., Brooklyn; John H. Milhau, M. D., New York; Richard Gundry, M. D., Spring Grove, Md.,; Carl H. Horsch, M. D., Dover, N. H.

Our special committee on Necrology will have prepared a fitting record of their lives and services for our public records. Here but little more can be done than to recall their names to your sympathetic remembrance.

ASIATIC CHOLERA.

In the annual report of the Supervising Surgeon-General of the United States Marine Hospital Service, issued since our last meeting, an interesting account is given of extended bacteriological experiments undertaken by Assistant Surgeon J. J. Kinyoun to ascertain whether there was an antagonism between the venom of the cobra and the poisons produced by the spirillum of Asiatic cholera, Mr. F. A. Perroux, of Calcutta, having reported that certain tribes in India use the cobra venom as a curative inoculation for cholera, the worst cases being stated to have been cured even when circulation had all but ceased.

Dr. Kinyoun carried out a careful series of experiments, both with regard to the germicidal action of the cobra venom upon the cholera spirillum in different nutrient culture media, and also after inoculation into rabbits. He came, as a result, to the following conclusions:

1. Cobra venom is germicidal to the cholera spirillum in a three-fourths of one per cent. solution.

2. There is no antagonism between cobra venom and the poison of the spirillum of cholera.

3. It will not prevent the coagulation of blood.

4. When the two poisons are administered together, or the cholera poison followed by the cobra venom, the toxic effects of cholera are intensified.

Attention has recently again been directed to the observations made by Dr. A. Harkin, of Belfast, in 1884. That observer dwells upon the physiological effects of the relations between the vagus and the sympathetic, and recommends the application of blistering fluid behind the right ear

with the idea of stimulating the vagus nerve so as to inhibit the action of the sympathetic on the abdomen. At the instance of the secretary of state for India, the government of India has forwarded this year to all their local governments and administrations copies of pamphlets entitled "The vagus treatment of Cholera," with a request that the mode of treatment therein recommended may be tested in selected hospitals.

LA GRIPPE.

The recurrence of the epidemic, or pandemic as it may almost be called, of la grippe this year has led to many investigations with the view of discovering its causal micro-organism. The result has not as yet apparently proved successful, although Babès has recently isolated two micro-organisms, to which he thinks that in all probability the pathological element in the causation of influenza may be attributed. We have advanced but little, if at all, from the hypotheses of last year. If we are to believe that the disease is caused by septic micro-organisms from the buccal or respiratory mucous membranes, we may suppose either that one or more of these acquire a greater virulence under the influence of meteorological conditions which affect each invaded district successively, or that these same atmospheric modifications, when they occur, lower the system to a degree that allows it to suffer from micro-organisms previously inoffensive. Certainly the simultaneous occurrence of such large numbers of cases as have been reported in various cities on the first day of its invasion differs markedly from the usual spread of disease from centres of infection. If, then, the disease is to be accepted as microbic, as we must from analogy doubt the possibility of the conveyance through the air for long distances of swarms of active micro-organisms, one of the above hypotheses of auto-infection under peculiar atmospheric conditions would seem to be what we are reduced to, pending further investigation.

Dr. Parsons, however, of the Local Government Board, and Dr. Sisley, in recent reports, claim that no unquestionable instance is recorded of the epidemic having commenced suddenly with a large number of simultaneous cases in a place previously free from the disease. They state that isolated cases have always preceded the epidemic outbreak. The first droppings of a thunder-shower point to a coming storm. The first cases of influenza point to an impending epidemic; but they do more,—they produce it by contagion. Parsons and Sisley believe that it is propagated mainly, or almost entirely, by human intercourse, and that the rapidity of spread is accounted for by the short period of incubation it undoubtedly possesses.

CANCER.

The relations which coccidiæ or psorosperms bear to innocent and malignant tumors are as yet undecided. Both Pfeiffer and Babès have described bodies of this nature which they have seen in cancers, and subsequently

Darier, Wickham, and others demonstrated their existence in Paget's disease and in various forms of cancer. But the question must still be considered an open one, as to which no dogmatic statement is as yet possible.

Russell's fuchsine bodies have generally been found in cancerous growths by observers throughout the year. Edington claims that they are a form of hyaline degeneration occurring in certain specific inflammations in tubercle, rhinoscleroma, etc., and also in certain new growths, more particularly in those that are somewhat rapid in their development; and that they have no relation whatever with fungi. And Shattock and Ballance regard them as either platelets, or red discs, which have undergone hyaline necrosis.

Numerous experiments have been made during this year for the relief or cure of inoperative malignant growths by the parenchymatous injections of methyl-violet—the pyoktanin of Stilling—so strongly recommended by Von Mosetig. Bearing in mind the affinity which the nuclei exhibit for analine dyes, the idea is that if these nuclei of the cells of the neoplasm could be destroyed its development would be checked. To this end Von Mosetig, as far back as 1883, tried the injection of trichlorate of aniline. This, on account of its disagreeable secondary effects, has recently been replaced by the pyoktanin.

TUBERCULOSIS.

At the time of our last annual meeting the excitement over the introduction of Koch's lymph for the cure of tuberculosis was as its height. All too quickly, however, after this "period of enthusiasm," came the "period of disbelief," heralded by the warning notes sounded by Virchow from fear of the freed bacilli seeking lodgment elsewhere, and by Liebman of Trieste, who found them in the blood from the fingers of patients under treatment, and confirmed by the general failure to find in tuberculin a successful curative agent.

In the early part of the year, Liebreich proposed the use in a similar way of the active principle of the Spanish fly, administered as the cantharidinate of potash,—his theory being that the remedy would cause transudation of blood serum at the affected part, and that this would act beneficially both by nourishing the cells so as to bring back to their normal condition badly nourished ones, and also by the disinfecting and germicide action of the serum upon the bacilli themselves.

Following Weigert's endeavor to destroy the bacilli in the lung by the inhalation of superheated air, Germain Sée introduced another treatment of tuberculosis by the continued inhalation of medicated air under pressure—the drugs used being creosote and eucalyptol.

Then as a sequence of the investigations into the germicide action of blood serum, and especially of those recent researches which show that the serum of naturally immune animals can be used to confer insusceptibility to a disease, came the injection, as a remedy for tuberculosis, of

goat's blood, by Bernheim, Picq and Bertin, and Lepine, and the injection of the blood serum of the dog, by Hericourt and Charles Richet, Saint Hilaire and Coupard, on the supposition that those animals were immune to the disease—a supposition which more recent researches by Chantemesse, Beucler, and Colin seem, however, to disprove.

That this country has not been behindhand in this matter is witnessed by, amongst others, the advocacy of the subcutaneous injection of gold and manganese by Dr. John Blake White, and that of vaccine lymph by Dr. J. Hilyard Tyndale.

More recently has come the presentation by M. Lannelongue, before the Académie de Médicine, of what he calls a method of prompt transformation of tuberculous products in the joints and certain other parts of the human body by deep local injections of weak solutions of chloride of zinc outside of and around the spreading edge of the tuberculous tissues.

And at the second congress for the study of tuberculosis, held in Paris in August now last past, the subcutaneous injection of guaiacol in sterilized oil of sweet almonds was advocated by Diamantberger and Weil, whilst Picot upheld his method of the injection of guaiacol and iodoform in sterilized oil and liquid vaseline.

Whatever may be the ultimate verdict upon the curative values of these various means of treatment, their introduction and study have led to marked advantage in several directions. The study of substances which have thus for the first time been found directly and specifically to affect tuberculous matter within the living body opens up a wide field of medical activity, by which not only tuberculosis but many other diseases may possibly be prevented or cured. Then the employment of tuberculin has made us familiar with the action of the chemical products of the bacillus tuberculosis upon man, and has stimulated the researches which during the last few years are becoming less and less directed to the micro-organisms themselves, and more and more to the chemical investigation of the albumoses, ptomaines, tox-albumens, etc., which are the products of their life history.

And from the free discussion of these remedies throughout the secular press at least this marked benefit has arisen,—that the general public must have become widely and intimately acquainted with our belief that tuberculosis is an infectious disease; that man belongs to a readily susceptible species; that the bacilli are the cause; and that the dried expectoration especially conveys and spreads the infection. When it is remembered that from $\frac{1}{7}$ to $\frac{1}{5}$ of all human deaths are stated to be from tuberculosis in some form, that we are told by Dr. Billings that in the United States alone there are 500,000 or 600,000 persons suffering from consumption, the importance is readily appreciated of the general diffusion of such knowledge as will reconcile the public to the enforcement of measures to control and limit its spread.

As recent instances of such measures, well worthy of general imitation and adoption under similar circumstances, the following may be men-

tioned: As a measure of precaution against the dangers to which Berlin was exposed last winter through the influx of tuberculous visitors, the police authorities, acting in concert with the municipality, issued an order by which all cases of tuberculosis, of whatever kind, occurring in hotels, boarding-houses, furnished lodgings, private sanitaria, etc., were to be classed amongst the infectious diseases. The heads of such establishments were obliged to take the usual precautions as to disinfection, and medical practitioners were obliged to give notice of such cases to the board of health within twenty-four hours.

Again: The disinfection of railway cars is receiving the attention of foreign railway companies. Practical action in a similar direction would not be amiss in this country. Owing to the tenacity of disease germs, it is wholly unknown how much they are disseminated by our luxuriously upholstered sleepers and coaches. Certainly, as has been well pointed out by a writer on this subject, it would be difficult to conceive of a conjunction of circumstances more thoroughly well adapted for the spread of consumption than is offered by the sleeping-car—overcrowded, ill-ventilated for fear of draughts, and with the temperature raised to a degree sufficient to rapidly dry and disseminate infectious matter. Now if it has been recently occupied by a consumptive patient—perhaps only en route for a change of climate—and if, through any cause, tuberculous sputa come to be deposited on any part of the car, what becomes of this if it be not dried and spread through the car and gradually into the lungs of the tired traveller?

In France they discard the velvet cushions and heavy drapery in the cars running to the southern districts when travel is heavy amongst passengers afflicted with pulmonary complaints, and have adopted, instead, soft leather coverings. The bed-clothing is thoroughly disinfected, and mattrasses are covered with impervious silk or with gutta-percha.

Moreover, from these free discussions, the fact has become more generally known that the danger of the infection of consumption comes chiefly from the expectorations. These dry on linen, on bed-clothes, on pocket handkerchiefs, in spittoons, on the floors of houses, the pavements of the streets, etc., are reduced to powder, suspended in the air, and thus breathed into the lungs,—a practical out come of this knowledge being the more general adoption of spittoons and spit-cups containing liquids. All vessels so used should be disinfected by boiling water, or better, steam, after the fluid contents have been cast into a fire.

The increased and increasing attention to the possibility of the spread of the disease by the use of tubercular meat or milk is another valuable outcome of increasing secular knowledge on this subject. And a check is now kept, or should be kept, by the inspectors of our cattle and of our meat and milk supplies in all our large towns. The boiling, or heating to nearly boiling, of the milk, and the thorough cooking of the meat, are precautions that are daily becoming more generally recognized and adopted.

One very marked advance during this year in regard to tuberculosis has

been the putting into operation in the United States of the new immigration law which came into force on the 1st of April last. By this new law consumption is classed as a "dangerous and contagious disease," barring admission to the country. Immigrants now suffering from it are ordered to be returned to the ports from whence they came.

DIPHTHERIA.

There are few infectious diseases upon which more light has been thrown by the study of their specific micro-organisms than has been the case with diphtheria. Since the important contributions of Löffler, and of Roux and Yersin last year, we have Klein's recent continued researches on those ailments of milch cows which have from time to time been discovered in association with epidemics of milk diphtheria, the investigations of the toxic albumens produced in cultures of this bacillus by Fränkel and Brieger, the experimental production of immunity by Fränkel and by Behring, and the observations as to the etiology of the disease by Welch and Abbott of the Johns Hopkins. These last observers conclude in favor of the doctrine that diphtheria is primarily a local disease, and that the grave constitutional symptoms are the result of intoxication with poisonous products formed by the local action of the bacilli. And they dwell on the great practical value for diagnostic purposes of a bacteriological examination, by cover glass preparations and by cultures, in this large group of cases often so puzzling to the practitioner.

Most interesting papers on this disease were read before the recent International Congress by two of our members, Dr. Hewitt of Minnesota and Dr. Abbott of Massachusetts. I trust that we are to have the privilege of hearing from one or both of these gentlemen on this subject during our present meeting.

BACILLARY PARTNERSHIPS.

In the series of observations herein referred to, Welch and Abbott noted that the faithful attendants of the Klebs-Löffler bacillus, the streptococci, were present also in the same situation.

Vaillard and Vincent, in their paper published in January last on tetanus, show that the tetanus bacillus cannot grow in the human body or develop its poisonous products without the presence of another micro-organism,—the disease being, therefore, in a sense, one of mixed infection. Cornil and Babès point out that a certain affinity exists between particular species of micro-organisms.

In other words, the development of special varieties may be facilitated, or the reverse, by the presence or preëxistence of certain other varieties. In this way the occasional complication of an existing infectious disease by a second is not the result of mere chance, but is governed by some still undefined conditions of environment. In other instances, this associ-

ation of two or more species of micro-organisms is necessary to the evolution of the malady. This association is the rule in the infectious diseases of human beings, and it is often the secondary infection that determines the fatal issue. This partnership arrangement may take place between micro-organisms belonging to more or less nearly related species as is the case with the organisms of pneumonia and enteric fever, or there may be streptococci and bacilli together as in diphtheria, or several varieties of streptococci as in the infection of wounds.

These facts may possibly throw some light on the rhythm and sequence of symptoms in the infectious diseases.

And as an indication for treatment when we thus know that, to cite only one example, the gravity of scarlet-fever is in direct relation with the presence of the bacteria of pus, we are confirmed in employing the most rigorous conditions of antisepsis, especially applied to the region of the mouth and throat.

DISINFECTION.

In a discussion before the Society of Medical Officers of Health of England, in February last, Wynter Blyth dwelt on the value of the recent researches of Behring, and Pfuhl upon the efficacy of lime as a disinfectant. Boer has also shown, that, while the addition of very small quantities of lime to a culture fluid greatly favored the development of bacteria, larger quantities, or the equivalents of potash and soda, were speedily fatal to all pathogenic organisms in any other form than the spore. Thus the strongly alkaline soft soap was a far better germicide than carbolic or thymol soap. And the lime washing of walls and ceilings, with scrubbing of the floor and wood-work with soft soap, was generally sufficient for the disinfection of a room. We shall all, I think, be ready to endorse Wynter Blyth's remark, that since we, as medical officers, must so often select the cheaper forms of disinfectants to use on a large scale, it is indeed satisfactory that the most recent researches confirm our belief that lime and alkaline soap must be exalted from the humble position of mere cleansing agencies to their proper position of true disinfectants.

Von Esmarch, also, has recently enumerated some of the points that should be especially attended to in the use of disinfection by steam.

These observations all confirm the conclusions and recommendations of the Committee on Disinfectants of this Association.

Their classical report on Disinfection and Disinfectants remains the standard text-book on those subjects, so indispensable to every sanitarian. Yet it is very expedient that the present position of disinfection should be dwelt on and reviewed from time to time. As the British *Medical Journal* says, "It may be said that these are all trusims, but they are truisms that are constantly being forgotten, especially by men whose experience is not very extensive."

IMMUNITY.

Researches have been continued since we last met, carrying on the interesting experiments showing that the blood serum of naturally immune animals and also of animals rendered artificially immune, can be used to confer insusceptibility to a disease.

Behring and Kitasato, at the end of last year, found that the serum of a diphtheria immune rabbit exerts no bactericidal action on the diphtheria bacillus, but that it possesses the remarkable power of destroying the poison produced by this micro-organism.

One of the most interesting discussions at the August meeting in London of the International Congress of Hygiene was that on the subject of immunity.

Metschnikoff championed his theory of the phagocytic action of the leucocytes, with their positive or negative chemiotaxis. He was ably supported therein by Roux.

Buchner tended rather to the theory that immunity is induced by some action of the blood, apparently independent of the amœboid cells.

Emmerich held that the cause of artificial immunity resides in an antibacterial, but, so far as the body cells are concerned, innocent toxin. This matter inimical to bacteria can be introduced into the body by vaccination; but it is also possible that the same substance may be formed from the body cells themselves by the stimulus of an invasion of bacteria.

Behring claimed that the bactericidal properties of the living organism are to be found in the blood serum deprived of all cells.

And Hankin submitted a new theory of immunity, which he stated as follows: "Immunity, whether natural or acquired, is due to the presence of substances which are formed by the metabolism of the animal rather than by that of the microbe, and which have the power of destroying either the microbe against which immunity is possessed, or the products on which their pathogenic action depends." To these substances—to which he considers the bacteria-killing power of the blood serum is due—he has given the name of "defensive proteids" (the "alexines of Buchner"). And Hankin points out that whilst when first the bactericidal action of blood serum was worked out, it was supposed that a serious blow had been struck at the theory of phagocytosis, the discovery of defensive proteids shows that this is by no means necessarily the case. He first obtained defensive proteids from the spleen and lymphatic glands of various animals; that is to say, they were obtained from cells which are potentially phagocytes. It is possible that they are the weapons used by phagocytes in their conflict with the micro-organisms, and that only after the death of the cells do these substances find their way into the blood serum.

In this connection I may briefly remind you of the researches of Behring and Fränkel, on acquired immunity in diphtheria, of Kitasato in tetanus, of Hankin, Ogata, Jasuhwara, and Woolridge in anthrax, and of Vassale, Montanari, and G. and F. Klemperer in pneumonia.

The recent endeavors to bring the results of such experiences as these to bear upon the treatment of tuberculosis I have already referred to.

Ashmead, of New York, has been carrying out a series of experiments based on the alleged immunity of the Japanese to scarlet-fever. He has been endeavoring, by the inoculation of an immune Japanese with scarlet-fever germs, to obtain a modified lymph to prevent scarlet-fever in the Caucasian.

These most interesting lines of research open up new possibilities which promise to lead to results of the very highest scientific and practical value.

This can be but a hurried and very incomplete retrospect, and that only touching one of the many sides of the subject. To attempt the full story of the progress of sanitary science during the past year would carry me far beyond such bounds as I have had to place upon myself. There are earnest workers in every quarter of the globe devoting highly gifted and well trained intelligences to the lessening of human illness and the saving of human life. If we need any fresh incentive to our labors, we have but to compare the death-roll of the past with that diminished mortality which has gone hand in hand with the scientific application of the principles of sanitary medicine to the circumstances in which we live.

Such studies as I have referred to thus briefly bring us nearer every day to the actual causes of infectious diseases. And with such knowledge, a means of prevention or cure can only be a matter of time. And, as has been well said, when we look at these recent advances in our knowledge of the intimate nature of infection and of the still hidden yet far reaching influence of disease, we are further stimulated to push ever onwards in friendly rivalry with those upon whom the laurels of the past have so deservedly been bestowed.

And now, ladies and gentlemen, allow me to express to you, in the name of the American Public Health Association, our appreciation of the kindly reception which has been tendered us by the people of Kansas City and its vicinity. The eloquent addresses of encouragement and of welcome to which we have had the pleasure of listening this evening cannot fail to cheer us in our work, and the effect of them, and of the interest shown by your presence in such large numbers this evening, will long dwell in our grateful and cordial remembrance. [Applause.]

II.

ADDRESS.

By Governor DAVID R. FRANCIS, of Missouri.

Mr. Chairman, Members of the American Public Health Association—Ladies and Gentlemen: An association which sprang from a desire to benefit humanity, and has for twenty years been maintained by scientific philanthropists for the purpose of checking disease, alleviating suffering, and promoting sanitation, is worthy of the support of all good citizens, and challenges the admiration of thinking men the world over. The American Public Health Association honors Missouri by its presence, and I am here in my official capacity, as chief executive of this commonwealth, not only to greet you with that warmth of welcome which characterizes Western hospitality, but to manifest and emphasize by act and word the deep interest our people feel in the laudable work in which you are engaged. [Applause.]

The march of civilization is being constantly marked by new discoveries in science, and by practical application their value is tested. We live much more than our forefathers did. Better a decade of this age, than half a century in the darkness of the Middle Ages. In our three score years and ten we live longer than did Methuselah through all his centuries, but our life is none the less precious; rather do we cling to it the more tenaciously: its increased advantages bring multiplied opportunities and additional obligations. Economic and social problems have become political issues. The age is intensely practical, but is constantly growing less selfish. A broader humanity is daily taking deeper root in the hearts of men. We, of America, having driven back the savage, cleared the forest, defined our possessions, and assumed our position among the nations of the earth, can turn our attention to the development of our resources, but cannot afford to overlook the social and sanitary condition of our people, if we would maintain that eminence and power which we have attained. The church recognizes that its offices must not be confined to directing its votaries to mere professions of belief: men will no longer be reconciled to the afflictions, hardships, inequalities, and oppressions of life by promises of equality and happiness in eternity. Church and state and society, enlightened, progressive, philanthropic, and practical, are all working to a common end—the elevation of man. The church, while not losing sight of his spiritual welfare, is endeavoring to help him to a better social order now and here. The state, while protecting life and property, is extending its authority to the aid of the weak

by enforcing recognition of the rights of humanity in order that oppression and defiance and desperation may not eventuate in the downfall of the governmental fabric and the reign of anarchy. Society, or civilization, or progress, imbued with moral convictions and impelled by practical ideas, is in the van of both church and state, battling against superstition and indifference for the betterment of the moral, intellectual, and physical condition of man.

You who have assembled here for the purpose of giving to each other and to the world the results of your labor and research for better sanitation and the prevention of disease are leaders in the great contest, and the state and humanity acknowledge obligation to you for scientific applications and discoveries. [Applause.]

There is a class of citizens—of eminent respectability, it may be—who are not pensioners, and do not oppress or transgress on the rights of their fellows, and bear their share of the public burdens in the shape of taxes that they cannot evade, but who consider their entire duty done when that much is accomplished. A community of such men would be an association of drones; a state composed of such citizens would lapse into barbarism. They are found in every city, town, and hamlet, but happily they are in the minority in this age and locality. They enjoy and accept with an air of meritorious proprietorship the "unearned increment" that results from the toil and enterprise of others whom they, in their professing conservatism, call speculative, ambitious, reckless. They have not the acumen to appreciate the value of an intelligent public spirit; their souls are too narrow to be moved by benevolent impulses, and their selfishness too absorbing to admit of beneficent acts. They live out the lease of life allotted them, their departure creates no void in the community, they pass away unwept and unhonored, and the world is no better for their having lived. Such men fail to comprehend the benefit of your work, and may look upon your efforts as valueless theories; but the observing student of history, and the far seeing, practical man of affairs, can see the beneficent results of your discoveries in every civilized country on the globe. [Applause.]

In addition to its moral grandeur, this sanitary work has a material value almost incomprehensible and certainly incalculable. If labor is the basis of all value, every human life must possess its proportionate worth. The great falling off in the death-rate, and the decided decrease in epidemics, are attributable to the better sanitary regulations, adopted after urgent solicitations from yourselves and your scientific colleagues or predecessors. The prevention of epidemics can best be appreciated by a community that has been visited by one. The loss is inestimable; immigration ceases, capital is alarmed, and improvements are unknown. Time, and a long period of time, is required to restore confidence, and quiet fear of a recurrence. But it is not necessary to demonstrate or recall the importance of your mission. Look at the individual estimate of life: every rational being makes it second to honor alone. The state

has wisely and rightfully assumed the authority to enact sanitary regulations and enforce their observance. The true province of government is not transcended, nor is the liberty of the citizen violated, when all are required to obey laws which conduce to the promotion of public health. The city or the state which adopts and enforces with firmness and impartiality the strictest sanitary regulations not only enhances its material interests, but adds a charm to the attractions of home, and inspires its children with a more devoted patriotism.

Gentlemen of the American Public Health Association, Scientists and Philanthropists, who have assembled here in this great Missouri valley in the pursuit of your high calling: Missouri recognizes in you representatives of the most advanced thought of the times and the highest type of citizenship, and salutes you as public benefactors. May your deliberations prove so abundantly successful as to inspire you with renewed zeal and redoubled efficiency in the noble work in which you are engaged. [Loud applause.]

III.

ADDRESS.

By Governor L. U. HUMPHREY, of Kansas.

Mr. Chairman, Ladies and Gentlemen of the Convention: I do not know how it is with my friend, Governor Francis, but I expect that his experience as governor of Missouri is not very much unlike that of other governors; for in Kansas the people of my state seem to have gotten the impression somehow that a governor has very little to do outside of signing notary public commissions and granting pardons. [Laughter.] They forget nowadays that it is a busy office—a constant grind and a perpetual task of one kind and another. They call upon him to go and attend all kinds of occasions and conventions. Now, gentlemen, I know very little about sanitation and hygiene. I might perhaps illustrate what I mean by telling you a singular experience. About a year ago I was proceeding to the south-western part of my state, of which I am proud,—and our good friends from Mexico and Canada will discover one peculiarity of us Western people, and that is, we have the privilege, and it is the right, of every man and woman of saying that we live in the best state in the Union and the best county in the state, and we do not quarrel about it,—and at a certain station there was a country fair proceeding very pleasantly, and, hearing that myself and one of the state officers were on the train, they came aboard and took us off, finding that we had a little time to spare. They then took us out to the fair-grounds, where there was a horse show going on, to say nothing of the agricultural exhibition and the usual things that one sees at a country fair. Among other things there was a minstrel show in town, who wanted to advertise themselves for the evening's entertainment. They took us out into the road, and then secured a wagon so that we could stand upon it and talk to the people on the seats; and they were to have the horse race first, then the colored minstrels would sing from the judge's stand, and one of us would make a speech. I told them that I had had many a funny experience in my life, but that this was the first time I was ever sandwiched in between a colored minstrel show and a horse race [laughter],—which, after all, ladies and gentlemen, simply illustrates the spirit of our institutions, and that the governor of a state is simply the hired man of the people. He does not get a good salary for it either. Governor Francis gets $2,000 a year more than I do; I think he ought to divide. [Laughter.]

Now, my good friends, while it is to me a great pleasure to be here tonight, I may say that I am the victim of a conspiracy, through the efforts of

your esteemed chairman, Dr. Lewis, and the able secretary of the Kansas State Board of Health. They extorted a promise from me about a month ago to be here to-night. I thought I could get out of it, but they kept after me all the time, so I am here. And now I am here, I am glad of it. While I have not an address to make, in the true sense of the term, I am proud of the opportunity to meet, greet, and become acquainted with the many eminent men who are engaged in the great work that has been spoken of by my friend, Governor Francis. While it is true that I came here with no expectation, but with the distinct understanding that I should not be expected to make any extended remarks, I do not know what I can say or add to what has been already said by Governor Francis this evening. The truth is, we have simply run away from public duty for a few hours to be present here to-night, and by my presence, rather than by any thing I may say, to testify to the deep interest I feel, as a citizen and public official, in the character, the scope, and the progress of the grand work you are doing for the people of this country through this Association. [Applause.] I say important: the subject of public health cannot be otherwise than important. The questions of sanitation and hygiene must always be considered important subjects, and of the deepest and most constant public solicitude. Of course, I am not familiar in any degree with the special work of your Association, nor am I in any measure acquainted scientifically with the subjects, that most naturally fall within the range of your discussions and deliberations. In fact, Mr. Chairman, my own ignorance on this subject, which I frankly confess,—because frankness is another name for honesty, and we are all honest in this country [laughter],—points to a moral, after all, and emphasizes the necessity and the wisdom for this sort of an Association, and for the work it is doing. Of course I understand, in a general way, that your organization is about twenty years old, not yet old enough to vote in this country [laughter]; that it is composed of distinguished and learned men, drawn, I suppose, largely from the medical profession, and embracing the territories that have been mentioned—the Dominion of Canada, the Republic of Mexico, and the United States. I understand also the purposes and objects which you are seeking to accomplish,—to diffuse knowledge, and to effect measures by which you may restrict, circumscribe, and, to some extent, prevent contagious and infectious diseases,—in a general way, to promote the public health and public good. When I contemplate the wide influence of your labors, I deem it a privilege—yes, I will go further than that, and say that I deem it a public duty—to stand here and extend to you, as an Association, a hearty welcome on behalf of the people of Kansas. [Applause.]

My friend, Governor Francis, spoke eloquently of the moral phase of your work. As he was talking, it occurred to me that he might have gone a step further, and added this idea,—as it comes within the limits of what lawyers term the general welfare clause of the constitution,—that the highest object of your Association is expressed in the recitals of the preambles and constitution of the United States, "the promotion of the general welfare." I

do not know that any man can conceive of anything greater, grander, and more correct than the promotion of the general welfare of a people through a public health association. So that, Mr. Chairman, it is no extravagance to say, that, in addition to the moral phase of your labors, your Association is in the highest and best sense a patriotic one; and, Mr. Chairman, your patriotism is evidently not of the kind of which I heard the other day. Somebody—I do n't know who—made the remark, that it was singular to notice a man in this country who was after an office,—how patriotic he was to begin with; but after a while, failing to reach the goal of his ambition politically, it was remarkable to notice how sadly his patriotism would "sag down in the middle." Yours is not that kind of patriotism; it does not sag down in the middle [laughter]; it is absolutely unselfish, and without any other hope of reward than that which comes to men from the consciousness of their duty to society and the state. It has occurred to me, that your investigations and your labors seem to run in different lines scientifically. Of course, you investigate the causes and conditions of disease, but it seems to me that the most difficult work you have to perform is in the matter of educating the public mind. I understand it to be a fact, that the first legislative enactment in this country upon the subject of public health was in the state of New York, less than fifty years ago; and when we consider the fact that the duty of the state in the premises is a subject which has recently been considered by legislators in this country, it is not singular, after all, that it requires a good deal of effort to educate the public mind, and the law-makers that they have a duty to perform in the premises. I know from experience how painful, inattentive, and indifferent the legislators of my state have been upon this subject. Of course they realize, what is true in the West, that the conditions do not exist which demand this so much as they do in the overcrowded and populous cities of the East. These conditions are going to come after a while, and the time to commence the matter of investigation and the education of the public mind is now.

We are very fortunate in having this distinguished convention assemble here in the City of Kansas, Missouri, for two reasons,—first, because it gives our friends an opportunity, which we are glad of, to entertain them; and, second, they can see this busy and bustling city, which is the growth of but a few years. The man lives to-day in good health who remembers when the site of this city was little better than a howling wilderness; and to-day we are glad to have those gentlemen from abroad see what a prosperous city it is, with its great commerce, which, of course, in the judgment and hope of every citizen of Kansas City, is destined in the near future to rival the greatest cities on the continent. [Applause.] There is a third reason: In my judgment it will have a tendency to educate and to stimulate interest in this subject, stimulate law-makers whose duty it is ever and anon to go to our legislatures and into our city councils to discuss this subject. I hope it will have the effect of stimulating interest in that direction upon the part of the people generally.

Now, Mr. Chairman, I have occupied as much time as I care to, and I simply want to repeat, that in behalf of the people of Kansas I extend to you their thanks; and I desire to express the hope that you will go away from here—if you do not conclude to locate here—bearing pleasant memories of the people of this city and country; that your deliberations will be pleasant and profitable; and that I shall have the pleasure of meeting you all again. [Loud applause.]

IV.

ADDRESS.

By Hon. JOHN L. PEAK, of Kansas City, Mo.

Mr. Chairman, and Gentlemen of the Convention: At a late hour to-day I was commissioned by his honor, the mayor of Kansas City, to express to you his sincere and profound regrets that other and pressing engagements had forbidden his personal appearance to-night; and he further commissioned me, in his name and in behalf of the people of the great city of which he is chief executive, to extend to this convention a cordial greeting and a hearty welcome. And I can assure you, gentlemen of the convention, that this welcome is none the less earnest and sincere because the unfortunate circumstance that you are gathered in our city at this particular juncture may furnish our enemies with the suggestion that the condition of our body, corporate and politic, must be desperate and perilous indeed to require the concentrated presence of such a vast number of skilful physicians and surgeons. [Laughter and applause.] We have become inured to calumny and detraction, until our wounds are no longer felt.

For a few months past it has been whispered, among those who envy our prosperity and greatness, that our city was laboring under a severe ailment. Some have ventured to prophesy that this ailment might prove fatal. It was first mildly suggested that, in all probability, it was but one of the types of disease incident to youth, commonly known as colic. [Laughter.] That a dose of catnip tea, wisely administered, would relieve the patient of all its difficulties. Inasmuch as the symptoms continue to be stubborn, other detractors ventured to suggest that it was not colic, but a case of epileptic convulsions superinduced by an overdose of real estate taken at an unguarded moment. [Laughter.] Many of the gentlemen who favor this theory of our condition, and suggest this diagnosis, are endeavoring strenuously to unload themselves of this deleterious and hurtful ailment, hoping thereby to relieve the patient. Others, again, have ventured the suggestion that it was neither colic nor epileptic convulsions, but a case of concussion of the spinal cord superinduced by a rapid descent from the lofty elevation of prosperity to which we had so speedily ascended. Others, again, still unwilling to accept either theory of the case, have ventured to suggest that it was a paralysis of our lower extremities. [Laughter.] These gentlemen are generally Eastern holders of suburban mortgages, who left more money in the city than they have yet been able to carry away. But I am satisfied that gentlemen of your

learned profession will have discovered, ere they shall have been long in our midst, that, whatever may have been the past ailments of our city, we are rapidly recovering from them; that we have strong, healthy, robust, and youthful bodies, capable of throwing off those symptoms of disease, and of beginning afresh with renewed energy in the race in which we have been engaged for the few years past, in making rapid strides in building up our city. We begin to feel the pulsations of a stronger life. Already the rich life-blood is coursing into and through our veins from the fertile fields of Kansas, New Mexico, Nebraska, and Colorado, and we are now preparing within the next decade to give to the world an exhibition of the most marvellous and stupendous growth ever witnessed upon the American continent. [Applause.] Only a few months ago I heard a gentleman, versed in such matters, an expert in calculation and in arithmetic, venture to say, before an audience larger than this, that, after a most careful and painstaking investigation, he had discovered it to be a fact, beyond controversy and dispute, in the brief coming time of 2191, the population of this city would amount to the enormous number of two billion, nine hundred and ninety-nine million, eight hundred and seventy-five thousand, one hundred and thirty-three and one third souls. [Roars of laughter.] I add the third for the sake of greater accuracy. I have no means at my command for verifying these figures. I have not the slightest reason on earth to question or doubt their accuracy; and if you, gentlemen, who are constituting this convention, rejuvenated and reinvigorated by the elixir which your profession has yet to discover, will return to our city in the fall of 2191 and hold your convention in our midst, we will treat you to such a royal reception as has never come to any convention since the days of Adam. We will transport you in palatial air vessels; conduct you through the magnificent temples erected to art and science; to your rapture and delight, unfold to you the beauties of our magnificent city, whose boundaries will then extend from the western borders of Kansas on the west to Missouri's capital on the east, and on the north to the southern line of Iowa and to the north line of Arkansas upon the south. [Applause.] Gentlemen, I venture to say that it is worth living three hundred years to witness such a sight as that. [Laughter.]

Gentlemen, we as citizens of Kansas City recognize in you the representatives of a grand, noble profession, which, in all ages of the world's history, has been foremost in the ranks of the promoters of the welfare and the well-being of society and of our race. It has been your duty to administer to the alleviation of the sufferings of human kind, to those racking pains which torture the body and vex the soul. It has been your lot to reveal to us those grand and magnificent laws which are conducive to health and promotive of the well-being of society. The task which you have assumed is far loftier and more exalted than that assigned the mythological hero of the past. The battle in which you are engaged is a real and earnest battle,—a battle against the real evils which impede and hinder the progress and development of our race. Not satisfied with having

revealed to us these laws, a knowledge of which is conducive to health and the preservation of life, you have turned the batteries of your science against the stronghold of nature, and demanded at her hands a surrender of those secrets the skilful use of which arrests the progress of disease and restores the physical organs of the body to their proper functions. The day is fast approaching when intellect and character will be recognized as the only real and genuine claimants to the homage of mankind. [Applause.] I think I may say further, that the day is not far distant when intellect and character, associated with the highest and best and truest service for our race, will be recognized and crowned as the only monarchs before which the human race shall take off their hats and bend their knees in homage. When that day shall come, gentlemen of the Association, I may venture the prediction that the profession you represent will be among the foremost ranks of those whom the voice of the age will recognize and crown as the only sovereigns among the sons of men. [Applause.]

In view of what you have been, of what you are, and of what you are to be, we bid you again a cordial welcome to our city; and with this welcome permit me to assure you that every possible precaution has been taken by his honor the mayor to secure your perfect protection and safety. The police department have received imperative orders to keep a watchful and guarded eye upon every member of your body, and to see to it that when this convention shall have been dissolved there shall be no report of any member strayed, lost, or stolen. [Laughter.] His honor the mayor has gone further than this, and has instructed the fire department to be on the watch and lookout. This precaution, gentlemen, was taken in order that you might prosecute your investigations and studies with all the deliberation and discussion which you might deem proper, and for the manufacture of any amount of gas which you might desire. [Laughter.] You shall be freed from the consternation of the dread consequences which might result from a premature ignition or explosion. The police department have been instructed also, that if any of you in your peregrinations through our city, investigating its sanitary condition, should become wearied and exhausted by your labors, and fall by the wayside, to carry you safely to your rooms and leave you in the hands of kind, loving friends. Having done all in our power to make your stay pleasant, safe, and secure, permit me again to extend to you a cordial welcome to our city, to our homes, and to our hearts; and accompanied with that welcome, permit me to express the hope of every citizen of this city, that your convention may be crowned with the highest measure of success of which your most enthusiastic and ardent members may have dared to dream. [Loud applause.]

V.

THE NECESSITY FOR MORE STRINGENT LEGISLATION TO REPRESS EMPIRICISM.

By ALBERT H. HORTON, Chief-Justice of the Supreme Court of Kansas,
Topeka, Kansas.

The forces which are silent and unseen are the most potent and creative. Thoughts are not thrown away, nor fancies squandered. Every enterprise or organization for the elevation or alleviation of mankind is the embodiment of many hopes and vague ambitions, gleaned by the careful economy of the mind, garnered, kept and shielded for the use and enrichment of future generations. To all comes pain; to a few has been given an intuition of pain; but to many, a desire to diffuse a general knowledge of its cause, and for its relief. Upon health, the happiness and prosperity of the world depend; the discoveries which increase its opportunities; the inventions which multiply its power; the attainments which deepen its wisdom; the accomplishment of all goodness and greatness; the joys of the heart, the lofty impulses of the soul. Health is the loving parent, the natural guardian, the tender nurse, the active promoter of all art, science, wealth, and religion. To preserve the health, to restrict and prevent disease, to disseminate sanitary knowledge, is the highest of missions, the noblest of aspirations. To commend the work of the American Public Health Association is to echo the voice of the people in hearty and earnest approval. Its labors, commenced nineteen years ago, have been indefatigable, unceasing, and effectual. A resident of Kansas, I bear willing testimony to the good it has done, knowing from many sources the powerful and happy influence it wields over all of the states, also through Canada and Mexico. It has a broad field, an active membership, unlimited possibilities; and as its past records success, so is its future bright with the promise of glorious fulfilment. There is a vast and important work awaiting always its consideration, not least of which is the eradication of evils; and first, because the worst and boldest of these, in most direct opposition to all advancement, to the spirit of progress and philanthropy, is empiricism or quackery.

Ages ago the Roman physicians marked their medicines with a small, greenish colored stone, engraved about the rim from right to left. A charlatan of the fallen empire, finding one of these, went travelling about the country, administering vile decoctions upon which he had placed the seal of the learned to deceive the unsuspecting. Taken grievously sick himself, and in his delirium forgetting that he had prepared the liquid

but recognizing the seal, he swallowed his own medicine, and died. The mountebank of the nineteenth century eschews all seals, and with brazen face and clarion voice travels the length and breadth of the land, calling himself "Diamond Dick,"[1] or by some other equally euphonious and ambiguous title, as he asserts his skill and disposes of his wares. It might not be justifiable homicide to compel him to swallow his darksome nostrums, but the present laws are insufficient for his repression, and however beside himself he might become, we can hardly hope that he will so far forget his villany as to administer unto himself that which he so recklessly deals out to others. Often, in Kansas, I have known one of these wandering quacks to visit various cities, advertise extravagantly his superior qualifications, stop a week or a month, take hundreds of dollars, benefit none, injure many, and then continue his travels,—everywhere bringing disrespect upon the profession of medicine, as well as pecuniary loss. Many of these restless, wandering, ignorant quacks have no more knowledge of the practice of medicine or surgery than a so called veterinary surgeon who resided in Osborn county in my state. Upon a trial in the district court of his county, he testified that after a close examination of some sheep, which were the subject of litigation and which were said to be diseased with "the scab," he was certain of the character of the disease, because he had made a close examination with an instrument. Thereupon he was asked what instrument he had used in his examination. He answered, "A telescope." The counsel were somewhat puzzled at this, and inquired of him if he was correct in his answer that he used a telescope. He said he was not sure whether it was a telescope or a telephone, but he used one or the other.

Pliny is accused of saying that "the Roman people got on for six hundred years without doctors." Americans could get on admirably *ad infinitum* without quacks.

There is a vein of superstition in the most practical. The mysterious, the wonderful, and the unaccountable cures these pretenders boast of having made, excite the credulous. Possible sufferers from chronic diseases, of which these men are prone to make a specialty, are induced to consult them, and finally to take their treatment. Their imaginations being worked upon, they are persuaded during the brief stay of the vender in the town, that they are greatly benefited or permanently cured, and people of honest intentions, of wealth and influence, are frequently inveigled into giving testimonials to this effect. When they discover the utter dupes they have been, they find that weeks before the medicine man "folded his tent, like an Arab, and silently stole away."

It were useless to pursue him, there is no law to reach him, and reputation is a word left out of his vocabulary.

An intelligent young man, who called upon one of these quacks in a Kansas town, was surprised by a proposition to travel with him and share

[1] "The old Indian doctor," "The Chinese herb physician."

the work and profits of the business. "But," the young man said, "I have no knowledge of medicine." "That makes no difference," said the doctor, "you look pretty wise; all you need, to humbug the people, is a silk hat and a pair of spectacles."

Empiricism is of ancient origin, and has its history. After the conquest of Greece by Alexander, centres of learning were formed and established in Pergamum and Alexandria. In the latter city, Erasistratus paved the way for the school of medicine known as the empiric. Serapion, a name distinguished in antiquity, and Glaucias, of Tarenton, are said to have traced the doctrine of empiricism back to Hippocrates, and are called its founders. The empirics would have nothing to do with anatomy. They argued that by this, and the rejection of cause, they gave closer and more accurate attention to "the actual phenomena of disease." Experience they claimed as the basis of their practice. By this, they meant observation, recorded observation, and judgment by analogy. Although among the ancients there were a few learned men belonging to the empiric school, its members were generally vain and pretentious, and so the name has been handed down to common and modern use, until it signifies to-day any pretender to medical or pharmaceutical knowledge and skill. In its oldest and best sense, empiricism referred to experience. It seems now to have been degraded into meaning experiment; and it is a barbarous and cruel wrong that in this enlightened age the ignorant and unskilled, but boastful, practitioner may go about unchallenged and unpunished, experimenting upon the sick, deceiving and entrapping the ignorant and the unwary. The Romans had a complicated system which they considered medicine. It united mystery, superstition, and religion. The unconscionable and unprincipled empiric of to-day does not hesitate to fortify his position, which is at all times hazardous and uncertain, by the recountal of any awesome story calculated to excite the curiosity, or inspire faith in his vaunted ability.

A great man in his own estimation is the quack. The frequent repetition of his power and genius affects his brain (if he is so endowed), and he comes at last to believe in himself, as each day's substantial evidence of his influence over others adds to his wealth and increases his cupidity. Not infrequently he is nameless, homeless; his only inheritance, vagrancy, coarse wit, and low buffoonery; his energies concentrated in his assurance. Warned by the omnipresent and uniformed son of Erin, like "Poor Joe," to "move on," he is compelled to cast about for the means of his migration. The glaring advertisements of some "Chinese herb doctor," or some similar quack, attract his wandering eyes, which are suddenly opened to the fortune awaiting him by turning to practical use his gift of song and dance, the general variety act, the coup de cunning of his kind. Obtaining a second-hand manicure set, he often commences his professional career as an itinerant chiropodist. As the shekels accumulate, he has a waking vision of coming greatness. He does not idly wait, but rather anticipates its arrival. He is fully persuaded that the term of

his apprenticeship is over. He need no longer skulk along the alleys, peering through daylight chinks into forbidden gardens. "Old rags, old bottles, old iron," are words without import. From the tattered novel he has learned to decipher, he selects an appellation of distinction. He is satisfied that M. D. is a fitting ending. "Medicine is medicine," he says, "and one doctor is as good as another," and finally, armed and equipped with powders and compounds, he finds an advance agent in the person of a former pal, and with Quixotic zeal starts out on his more adventurous quest. At a corner of the public square, in some rural town, he mounts an improvised rostrum and begins his loud harangue. He is soon surrounded by a curious throng of willing listeners. "Now," he shouts, "if there is a deaf man in this crowd, let him come on and I will give him a free treatment." As there is a deaf man in every crowd, his patient soon appears. Crying in stentorian voice the efficacy of his so called remedy, he drops a portion of it into the ear of his waiting victim. While the people laugh and jest and the din becomes uproarious, he suddenly proclaims to the man that he is cured. "Is it not so?" he calls. Half bewildered by the seeming enthusiasm around him, and influenced by the boldness of the assertion, and hearing distinctly a voice that would almost wake the dead, he believes for the moment that he is cured, and so affirms, amidst the applauding crowd, who, when they hear that the preparation not only cures the deaf, but any case of croup or cold, is good for sore throat, rheumatism, and sore eyes, will cure corns and mend picture frames, and is therefore an invaluable family remedy, press, crowd, and mangle each other in their eagerness to secure a package before it is all gone. Frequently the aforesaid pal assumes the role of the deaf man, and thus becomes an accessory in the nefarious practice of his companion. The mountebank proper is often only a night in a town,—having pressing and particular reasons for speeding onward,—but during his brief stay he reaps a golden harvest, which amply rewards him for his tricks in trade, of which he has inexhaustible stores. I have especially cited the loud and most numerous specimen of the genus quack; but there is another, equally well known and still more damaging to the medical profession, because, while not so grotesque and glaring a travesty, his pretensions are as illy in keeping with his acquirements. There is more tact and method and dignity, if the word applies, in the madness of the second pretender. He has, sometimes, had the advantage of the common school and the benefit of a name. Like the first, he is a great braggart, but his praises come on printed handbills, which he puts into immediate circulation. He purports to come from one of the leading cities, where he claims to have a large and lucrative practice. He promises to cure any and every disease, and privately names his fee, which for a resident physician would be considered exorbitant. He claims it is much below his city price, and apologizes for its meagreness, saying that the figure is low because this is simply his "advertising trip." By a regular system of finesse and chicanery, he secures, during the third or fourth day of his stay, testimonials from prominent citizens of

the cures he is said to have performed for them. He is afterwards rushed with calls at all hours of the day and night, and the money flows freely into his coffers to the wanton aggrandizement of utter worthlessness and presumptuous arrogance. He writes no prescriptions, mixes his own ridiculous compounds, is entirely an unidentified and suspicious stranger, yet he supersedes the practice of the legitimate physician, and pockets in less than two months a sum considered a fair salary for a year; but, unlimited and unrestrained, he pursues his course, which is alike an imposition upon the people and ruinous to the medical profession. Then there is the resident quack, who may be found in every city. He sometimes claims to be a great specialist, but more often announces himself able to perform cures in every case and stage of disease. He is as thoroughly an impostor as the others, his knowledge is as superficial, his pretensions are as bombastic. He becomes notorious by his constant and liberal advertisements. He is consulted from far and near. Though some lose all faith in him, there are many more upon whom he continues to practise his system of fraud and deceit. There are hundreds of gullible readers taken by his alluring promises in the daily papers; and so, to the general detriment, he contrives to keep and increase his patronage. Comparisons are said to be odious, yet here I would like to define the difference between the quack and the physician.

I recall with affectionate remembrance our family physician, upon whom from my earliest childhood I looked with youthful reverence and unquestioning faith. Before me, to-day, I see his kindly face and listen to his pleasant voice. He was a very hero in my eyes, of commanding figure and magnificent physique. There could be no finer, braver, better man. He was the wise counsellor, the skilled restorer, the sympathetic friend. The silver had crept into his hair, and careful thought and much exposure had lined his brow, but there was ever about him a brightness and cheeriness which seemed a part of his presence, only that it lingered after he had gone. I recollect that one of our neighbors went raving crazy, and with a gleaming razor menaced a crowd which gathered around him. But the doctor, alone, rushed dauntlessly forward, overpowered and unhanded him, exhibiting a physical courage and prowess sufficient to win the heart of any boy. Yet it was not this instance of fearlessness in time of danger which in my maturer judgment went furthest to prove his resolution and heroism. It was the tried and constant disregard of self, through the long years of a varied practice. No call was disregarded, no contagion appalled, no storm or tempest ever dismayed him. The humble and poor received his attentions in equal measure with the wealthy and the influential. All of his life he went about doing good, ministering to the afflicted. His heart was in his work. His zeal, energy, patience, skill, and industry combined in modelling the man fit for the highest ideal of life.

> "A combination and a form indeed,
> Where every god did seem to set his seal,
> To give the world assurance of a man."

If not the powerful genius that my childish fancy pictured him, he was certainly a good and earnest man; and goodness and earnestness, it seems to me, are necessary essentials in the character of the family physician. His part in life is not a mere by-play. He enters into its highest creations, its most thrilling scenes, its deepest, stirring tragedies. As the river flows grandly to the sea, bearing upon its bosom the burdens committed to its care, turning the mill and fertilizing the valley, contributing to the peace and prosperity of its surroundings a strong and gladdening, but silent, influence, so should the life of the educated physician be directed, guarded, dutiful, conscientious. As from many hidden springs the river gathers strength and force, so should the deep principles of courage, generosity, truth, honor, humility, kindness, and, above all, sincerity, unite in forming the character of the physician. It should be his study to reject the bad, to accept and disseminate the good. So, ever by circuitous and difficult journeyings, his opportunities score his successes. Here the fruits of his labors gladden his vision, and there the flowers of gratitude spring brightly into his existence. The wounded healed, the sick restored to health, the dying soothed, the bereaved comforted, every trust held sacred, every family secret safe in the guarded sanctuary of his soul, ever seeking further knowledge, which finding, he reveals,—the good physician may feel the completeness of his life work. As the branches of the forest extend over the gleaming river, which joyfully mirrors their ceaseless congratulations, so, ever above him, the strong, kind hands of a relieved humanity reach out in warm and earnest grasp and sheltering benedictions. His duty well performed, his conscience clear, his faith kept, his mind is a happy and tranquil reflection. As from the bounteous arms of the trees blossoms and leaflets fall quivering into the responsive heart of the river, so, from the grateful hands of the restored and healed, green laurels of acknowledgment, in words and looks, unnoted by the world, sink deeply in his heart of hearts, adding many gleams of pleasure to the life of the earnest toiler.

The courts of the various states of the Union have frequently announced the doctrine that the legislatures have ample power to prohibit quackery or empiricism.

The supreme court of my own state recently said, in the case of *State* vs. *Creditor*, 44 Kansas 565, that "The power of the legislature to regulate the practice of medicine, dentistry, or surgery is undoubted; it is an exercise of the police power of the state for the protection of the health, and the promotion of the comfort and welfare, of the people. It may provide that only those possessing skill, and learned in these professions, shall be permitted to practise; may prescribe the nature and extent of the qualifications required, and the rules for ascertaining and determining whether those proposing to practise come up to the statutory standard. If the regulations and conditions are adopted in good faith, and they operate equally upon all who may desire to practise and who possess the required qualifications, and if they are adapted to the legislative purpose of promot-

ing the health and welfare of the people by excluding from the practice those who are ignorant and incapable, then the fact that the conditions may be rigorous, impolitic, and unjust will not render the legislation invalid."

Mr. Justice Field, of the United States supreme court, in delivering the opinion in *Dent* vs. *West Virginia*, 129 U. S. 114, said, among other things, that "The power of the state to provide for the general welfare of its people authorizes it to prescribe all such regulations as in its judgment will secure or tend to secure them against the consequences of ignorance and incapacity, as well as of deception and fraud. As one means to this end, it has been the practice of different states, from time immemorial, to exact in many pursuits a certain degree of skill and learning, upon which the community may confidently rely, their possession being generally ascertained upon an examination of parties by competent persons, or inferred from a certificate to them in the form of a diploma or license from an institution established for instruction on the subjects, scientific and otherwise, with which such pursuits have to deal. . . . .

"Few professions require more careful preparation by one who seeks to enter it than that of medicine. It has to deal with all those subtle and mysterious influences upon which health and life depend, and requires not only a knowledge of the properties of vegetable and mineral substances, but of the human body in all its complicated parts, and their relation to each other, as well as their influence upon the mind. The physician must be able to detect readily the presence of disease, and prescribe appropriate remedies for its removal. Every one may have occasion to consult him, but comparatively few can judge of the qualifications of learning and skill which he possesses. . . . . No one has a right to practise medicine without having the necessary qualifications of learning and skill; and the statute only requires that whoever assumes, by offering to the community his services as a physician, that he possesses such learning and skill, shall present evidence of it by a certificate or license from a body designated by the state as competent to judge of his qualifications."

In *People* vs. *Phippin*, the supreme court of Michigan, in 1888, decided that "There is no good reason why restraints should not be placed upon the practice of medicine as well as the law. The public are more directly interested in this than in the practice of the law, and persons who engage in this profession require a special education to qualify them to practise. A great majority of the public know little of the anatomy of the human system, or of the nature of the ills that human flesh is heir to, and there is no profession, no occupation or calling, where people may more easily or readily be imposed upon by charlatans. It is almost an every-day experience that people afflicted with disease will purchase and swallow all sorts of nostrums because some quack has recommended them. Up to the passage of the act in question, the people of this state were wholly unprotected against quackery, except such protection as the common law afforded. As early as 1806 the supreme court of New York affirmed a

judgment against a physician, inflicting a fine on him of $25 for practising medicine contrary to the provisions of an act of the legislature." 37 N. W. Rep. 888.

In *Eastman* vs. *The State*, 109 Ind. 278, Chief-Justice Elliott said,—"The practice of medicine and surgery is a vocation that very nearly concerns the comfort, health, and life of every person in the land. Physicians and surgeons have committed to their care the most important interests, and it is an almost imperious necessity that only persons possessing skill and knowledge should be permitted to practise medicine and surgery. For centuries the law has required physicians to possess and exercise skill and learning, for it has mulcted in damages those who pretend to be physicians and surgeons but have neither learning nor skill. It is, therefore, no new principle of law that is asserted by our statute; but, if it were, it would not condemn the statute, for the statute is an exercise of the police power inherent in the state. It is—no one can doubt—of high importance to the community that health, limb, and life should not be left to the treatment of ignorant pretenders and charlatans. It is within the power of the legislature to enact such laws as will protect the people from ignorant pretenders, and secure them the services of reputable, skilled, and learned men, although it is not within the power of the legislature to discriminate in favor of any particular school of medicine. When intelligent and educated men differ in their theories, the legislature has no power to condemn the one or approve the other, but it may require learning and skill in the school of medicine which the physician professes to practise."

In *State ex rel. Powell* vs. *The State Medical Examining Board*, 32 Minn. 324, the supreme court of Minnesota decided that "The legislature has surely the same power to require, as a condition of the right to practise this profession, that the practitioner shall be possessed of the qualifications of honor and a good moral character, as it has to require that he shall be learned in the profession. It cannot be doubted that the legislature has authority, in the exercise of its police power, to make such reasonable requirements as may be calculated to bar from admission to this profession dishonorable men, whose principles or practices are such as to render them unfit to be entrusted with the discharge of its duties. And as the duty of determining upon these qualifications, both as to learning and skill, and as to honor and moral fitness, must from necessity be committed to some person or body other than the legislature, we see no reason why it may not be committed to the legally constituted body of men, learned in this profession, named in this act. . . . . In the profession of medicine, as in that of the law, so great is the necessity for special qualification in the practitioner, and so injurious the consequences likely to result from a want of it, that the power of the legislature to prescribe such reasonable conditions as are calculated to exclude from the profession those who are unfitted to discharge its duties cannot be doubted."

The decisions of various other states might be cited, if time permitted, in support of the views herein expressed. I have quoted, however, suf-

ficiently from the highest judicial tribunals of the country to establish the doctrine that when the medical profession, the boards of health, or any other fraternity or association, demand the enactment of severe and effectual measures by the legislatures of the various states to repress and punish empiricism, they have a strong legal foundation upon which to work and build. They are not asking for doubtful or questionable legislation, but only such as has been approved by the ablest judicial officials of the nation.

Attempts have been made in Kansas and in several other states of the Union to prevent by legislation the practice of medicine by empirics, but thus far these laws have generally been too loosely framed to be effective or valuable. The necessity for more stringent legislation in this matter is apparent. If the tramp, who simply refuses to work, but begs his bread, may be punished by imprisonment in the city or county jail, more certainly should the medical tramp, ignorant and unskilled, who imposes upon and defrauds the people, be subjected to the law's severest penalties. To protect the public, the American Public Health Association should recommend the enactment of statutes excluding from the medical profession those who are not competent, by learning, skill, and experience, to practise, and punishing by imprisonment all who violate its provisions. No one should be permitted to practise medicine or engage in surgery unless authorized so to do by a competent board of government or state examiners appointed under authority of law. A mere diploma should not be sufficient to authorize the holder to practise any profession. In the law, the diploma of a law school is some evidence of the learning of the holder, but, as a general rule, not conclusive. So, the diploma of a physician or surgeon ought not to be conclusive of his learning or skill. A further and more thorough examination should be had, under the authority of the government or state, before any physician is permitted to engage in practice. I am aware there are many difficulties in the way of obtaining effective legislation upon the subject discussed. The quacks themselves, who are numerous, and who occasionally are found in the legislatures, will, out of self-interest, oppose the adoption of any sufficient statute. Then, again, the people themselves need education upon this subject. They are slow to act, even in their own interest, but energy and perseverance will accomplish great results. The work along the line proposed should be renewed, and be even more active than in the past. Something more may be accomplished than has already been done. In any event, beneficial results will be obtained.

In the divine creation of medical science there is no niche or corner for the quack. In modern paintings, one main action, one point of view, and one instant of time are required. In sculpture, the ancient Egyptians disregarded all these rules, and as their religion forbade them to follow nature in the human form, their copies were restricted and incongruous. To the medical body, the quack is a disproportioned, ill-formed, and superfluous limb. The arm of the law should restrain him from seeking

to unite himself with that which he is unfitted to approach. He is not only a plain disfigurement, but a strange and unnatural incumbrance, which it is the duty of the body politic for its own health to remove. Yet not only in its own behalf would I urge this expedient, but for the broader and more comprehensive cause of right and justice in the interests of all humanity.

As the medical fraternity has been compelled to bear the ridicule, to feel the ignominy, and to share the burden and the loss which have been brought upon it by the empiric, so should it be the special work of the members of that fraternity belonging to this Association, as the mountains part the clouds and as the continents divide the seas, to erect impassable barriers which shall forever separate from them this disgraceful humiliation.

In Catholic countries, wherever a murder is known to have been committed, a cross is erected, the ever touching symbol of unmerited suffering. As in the life of the well meaning and ordinary individual the years are frequently compared to milestones, so it seems to me that all along the roadway of him who under the guise of competency and qualification pretends to alleviate the distress of others, but really adds to their pain, prolongs their agony, or causes their untimely death, the white cross rises in speechless condemnation. The rocks and the innumerable pebbles which mark his path assume this form, and all give silent evidence against him. Shall the medical members of this Association, noticing this convincing and irrefutable testimony, remain inert? Shall they become willing accomplices to the criminal, his equal associates and confederates? As theirs is the joy of fanning into life the flickering flame, of soothing and ameliorating, of calming, upbuilding, and restoring; as theirs has been the honest study, the long research, the willing devotion, and the conscientious toil,—so be it theirs for all mankind, in the interest of a consecrated cause, to extirpate such enemies and expel such foes.

VI.

NOTES ON THE HYGIENE OF RICE-CULTURE.

By DR. NAZARIO LOMAS, Cuernavaca, Morelos, Mexico,

Member of the Board of Health of the State of Morelos, and Director of the General Hospital.

Gentlemen: If it be true from the utilitarian point of view that water can be considered as the blood of the earth, the life of the fields, and the fountain of many benefits to man, it is no less true, that, looking on the reverse of the medal, and submitting it to the test of rural hygiene, this same water loses its property of vivifying blood, and transforms itself into a source of deadly and pestilential miasmas, decimating the population where it is and driving away the men, so that cultivation in its neighborhood becomes almost, if not quite, impossible. The result is, that precisely where the fructification of the earth is most valuable, the conditions under which it can be obtained are the most mortiferous.

The conditions under which water comes to be a factor in a cultivation of this class are well known to you, and the word swamps will at once give you an idea of the part of hydrology to which I refer.

At all times and in all countries the swamps have been the subject of innumerable hydraulic and medical studies. The latter of these have shown us how the effluvia from the swamps of the mouths or deltas of the three great rivers of Africa, America, and Asia, breed all kinds of pestilence, yellow-fever, and cholera. We have before us the nosological history of the old canal of Manzanares, the canal of Urgel, the swamp of Oropeza, and the irrigations of Valencia in Spain; the Pontine Lagoons and the Ombrone in Italy; the Bombes (Ain) in France; the Pinsk swamp in Russia, etc.; and the Mexico valley with its beautiful lakes in my own country. In all these points the rate of mortality due to the emanations and miasmas arising from these swamps is something frightful. In these matters science speaks to us with the statistical data, presenting the registers of the cemeteries, and at the same time lends a very valuable help, and in a thousand forms, to the governments in their efforts towards a reform by means of canalization, drainage, and general sanitation of these deadly sources of disease,—which may be called a kind of Pandora's box, which at times permits the escape of exotic travellers, like the one that originated on the Ganges.

From what I have hitherto said, it may be thought that I refer to what might be called faults in the conformation of our globe, of natural

accidents, or of bad selection on the part of the founders of certain cities. But there are cases in which the very development of a particular zone, in its agricultural resources, obliges man at the same time to unite with nature in the formation of swamps, resulting in the contingent which has always to be paid of suffering and mortality.

As a representative for the state of Morelos, one of the most fertile of the Mexican Union, I have acquired the necessary data to elucidate any question that may arise concerning its hydrographic hygiene, as well as its irrigation and agricultural hygiene. For choice, I have preferred to treat of the hygiene of rice-culture, because for the last five years the cultivation of rice by irrigation is taking the position of one of the principal elements of the richness of that state. During that time the plantations have considerably increased, whilst the salubrity of certain towns has proportionately decreased. And it could not be otherwise, seeing that the irrigations of the rice form swamps, which are exposed to the mean temperature of 33 degrees centigrade in the summer, and 28 degrees centigrade in winter. I presume that you are already acquainted with the cultivation of this plant, and that I can therefore omit a description of the same. At the same time, I would remind you that its cultivation is distinguished by dry system (on hills) and by irrigation; the latter being subdivided, according to the system of irrigation, into two classes, called irrigation by current, and irrigation by flooding.

The system of irrigation by flood, which happily we do not know in the state of Morelos, but which may be introduced later on as the rice-culture progresses, is the worst of all, and is that which has obliged those who have any experience of it to declare that the cultivation of rice is homicidal, that its history is one of blood, and that sixteen hectolitres of rice cost the life of one man. Its irrigation unites in the most effective manner all the evils of the worst of the sweet water swamps. I make mention of this, because it is proposed in my state as one of the intended hygienic measures.

The rice cultivated under the system of irrigation by current, a system that has been generally adopted in that state, is irrigated, from the month of February to September, by currents which are renewed according to the necessities of the plant, and which in general are continuous. But it would be impossible for the ground to have the perfect inclination of a plane, so that the waters should be completely drained off; and the result is, that, in fields of any great extension, hollows are found which form swamps. It also very often occurs, that at the points of entrance or outlet of the water used for irrigation lagoons should be formed by the want or imperfection of canals and drains. Even supposing that this class of irrigation should be carried out in the most perfect manner, we should always have the evaporation from an immense superficies, composed of earth very rich in vegetable organic matter. The harvest begins in September, and this

operation leaves on the surface of the ground, more or less damp and swampy, a great quantity of straw and vegetable detritus, whose decomposition impregnates the atmosphere with emanations and miasmas highly prejudicial to public health.

With respect to the cultivation of rice by dry system on hillsides, I am not practically acquainted with it; but we can easily understand that if it is not as productive as the other systems, it is, on the other hand, not as unhealthy.

Once we have formed this class of artificial swamps with a large superficial extension, we have as a natural result a powerful source of paludic fevers, and all classes of gastro-intestinal affections, which are of themselves endemic in the districts dedicated to the cultivation of rice.

My attention is particularly drawn to these paludic fevers, because their increase follows the progress of the rice industry in the neighborhood, and because the number of those attacked by this kind of fever exceeds fifty per cent. of the people employed in that culture. The fever appears under all its forms, but it is found mostly to attack under the form of daily intermittents, tertiary and continuous fever, being accompanied almost immediately in the first two cases by a swelling and hardness of spleen, and very often of the liver. It is to be noted that the continuous or intermittent fevers do not at once take on this character, being usually preceded by two or three attacks of daily intermittent fevers, whose duration gradually becomes longer until it becomes continuous or remittent; and notwithstanding its paludic nature, it is not found amenable to any form of quinine. On a smaller scale we find neuralgia, especially in the form of trigeminus, urticaria, and purple spots very frequent. Pneumonia takes here the form of an epidemic, and is cured or very favorably influenced by the use of salts of quinine: this is observed in the battalions which come from the south. The day laborers who come down from the central tableland and the valley of Mexico are almost invariably attacked by cachexy on arrival.

It is well to inform you that the state of Morelos forms an inclined plane from north to south, the highest parts of which are situated at an elevation of 2,000 meters above the sea, and the lowest at 500 to 650 meters above the same.

The prevailing winds by day are from south to north; and by night, from north to south.

There is abundance of water both from springs and rivers;—the first is sweet, and the second, sweet and salt.

Considering the fall throughout the state, the course of its water is naturally opposed to the formation of lagoons or swamps, and in former times the climate must have been very healthy.

The lowest part of the state is that which is dedicated to the cultivation of rice and sugar cane, the latter being another source of paludism.

The hygienic measures which the state board of health submitted to the approbation of the government through my initiative, are as follows:

1. The cultivation of rice by the flooding system is in no case to be allowed, even as a trial.

2. New rice plantations shall only be allowed to be established under license from the governor; and for the granting of such license the board of health must be consulted, the state engineer forming part of such board. This corporation will appoint a committee to study the subject, composed of one of its members resident in Cuernavaca, a doctor from the rice cultivation district, who may be a corresponding member of the board, and of the state engineer.

3. If the ground proposed for such cultivation is situated directly to the south or the north of any village or town, and distant therefrom less than 3,000 meters, the petition is at once refused,—unless in the judgment of the health experts not less than three in number, and by unanimity, they should declare that the existence of an intervening hill or forest, or other such natural feature, removes the danger consequent on such cultivation.

4. The rice planters who commence their harvest with the ground in a soaked condition, when such condition arises from bad management or carelessness in not retiring the waters in due season, shall be liable to a fine of not less than $50, the amount being fixed in consultation with the governor, and will be deposited in the funds of the board.

5. The cultivation of rice shall be suspended on any plantation whenever, in the judgment of the engineer of the board, the irrigation waters form swamps or lagoons either at the intake or the outlet. Once these defects are removed, the permission to cultivate may be renewed.

6. Any person may denounce, before the board or its correspondents in the district, any defects in the irrigation or cultivation which may give rise to the formation of swamps.

7. Whenever the rice is beaten down by strong winds, hail-storms, etc., it must at once be cut, and especially so if it is in the water.

8. The laborers employed in rice-culture will only work after sunrise and will leave the fields before sunset.

9. The field overseers will under no circumstances allow the wives of the laborers to bring them their meals or visit them in the fields. This prohibition applies with much more reason to children.

10. The owners and administrators of rice plantations, who desire the well-being of their laborers, can address the state board of health, and obtain from it a pamphlet containing instructions for the prevention and cure of paludic fever.

VII.

NEW ORGANIZATION OF THE SUPREME BOARD OF HEALTH OF THE MEXICAN REPUBLIC.

By Dr. DOMINGO ORVAÑANOS,

Member of the Supreme Board of Health of Mexico.

The sanitary laws which were in force in Mexico, from the date of the independence up to the year 1829, were almost exclusively limited to the regulations relative to the exercise of medicine and pharmacy, and had been almost entirely issued by the vice-regal government. They were absolutely without any order, and mixed with others foreign to the subject, for which reason they were very little known to the public. Besides this, they were in many points opposed to the new laws enacted by the republican government, the result being that observance had come to be almost entirely neglected. In the year 1830 Señor Febles united the whole of these laws in a single code, which he proposed to the government for the purpose of remedying the abuses which daily increased in the exercise of the medical profession. Something was done towards correcting these evils by the publication of this code; and the "Proto-Medical Commission," which had been charged with the vigilance of this branch of public business, put more energy into their department, and afterwards proposed to give a wider scope to the same, proposing the creation of a Supreme Board of Public Health. This board was constituted in the year 1841 with the character of a consulting body in everything that referred to public hygiene, its proposed laws being subject to the approval of the administrative power.

During the following years very little result was obtained from this reform, as the board almost limited itself to the resolution of questions concerning public hygiene as proposed by the authorities, and to the proposal of an occasional measure to improve sanitation; but as its opinions were seldom adopted, its right of initiating reforms was almost lost by disuse. The continual political revolutions that followed one another in our republic until the year 1867 in a great measure prevented the advance of this branch of public reform. When at last the republican institutions triumphed, and brought with them peace founded on solid basis, the authority or authorities found opportunity to occupy themselves afresh with sanitary matters, placing in force some of the old ordinances, and promulgating new ones. Almost all of these regulations will be found condensed in the "Collection of Municipal Laws and Regulations of the Federal District," published by José Castillo Velasco, in the year 1874.

Notwithstanding this, as these regulations could easily be modified or revoked by the same administrative authority which had dictated them, very little was gained in the way of true progress.

In the year 1876, with the establishment of the government under General Diaz, the board was reorganized, and although it continued to have a merely consulting character, its resolutions were fortunately accepted, and it began to exercise a great influence in all sanitary questions, thus placing it in a position of respectability and good standing such as it had never enjoyed. The number of members composing the board was considerably increased, the employés were better paid, new departments were created and the old ones improved, and orders were issued for the formation of a Sanitary Code. During a pleasure trip which General Diaz made to this country, in company with his physician, Dr. Edward Liceaga, during the year 1882, he commissioned this intelligent doctor to take special note of everything relative to public hygiene and sanitary legislation; and Dr. Liceaga collected valuable data on the matter, which he placed at the disposal of the board of health in Mexico. Later on, the same Dr. Liceaga and Dr. Nicolas Ramirez Arellano journeyed through Europe, visiting the cities of London, Berlin, Vienna, Brussells, and Paris, whilst the speaker visited the boards of health of New York, Boston, and Philadelphia. We all used our best endeavors to obtain valuable lessons in these great cities, and we returned to our country with the anxious desire of implanting therein all of those improvements which could be made to combine with our laws, our customs, and our necessities.

The board then commenced to work energetically in the formation of different regulations, which, once placed in practice, showed the utility or the defects of the provisions which later on were to constitute our Sanitary Code; and thus it happens that many of the articles in the code which has lately been promulgated have really been under observation for several years. Experience has shown us the modifications that ought to be adopted, and convinced us most profoundly that in order to reap the full advantages of the work of the board and of its deliberations it ought to have sufficient stability and be invested with executive authority. In fact, the carrying out of measures of sanitary regulations has been in charge of the city council, and this practice has not resulted in the desired progress, for the reason that very rarely do we find persons in those bodies who are sufficiently competent in matters of public hygiene, and because the excessive decentralization of sanitary administration has never produced good results. For these reasons, and because a very wide interest has been awakened during the last few years in this country, both on the part of the government and of the public, in all matters relating to sanitation, we have been able to obtain the passage of the sanitary law, of which I am now going to treat, and which invests the supreme board of health with the necessary authority for the effective carrying out of its dispositions.

By decree dated 18th December, 1889, the congress of the Union authorized the executive to issue a Sanitary Code for the republic, which had been carefully studied by the supreme board of health. These proposed regulations were submitted to a committee of competent lawyers, in order that they should put it in legal shape and add to it the penal clauses. This commission terminated its labors at the beginning of July of the present year, submitting their deliberations to the approval of the president of the republic, who on the 12th of July promulgated the code referred to, bringing it into force on the 1st of August.

The Sanitary Code is divided into four books, preceded by a chapter which treats of the organization of the sanitary service.

This is divided into federal and local service. The federal administration will be exercised by (1) the secretary of government, supreme chief of the sanitary department; (2) the supreme board of health; (3) the local boards of health in the ports and frontier towns; (4) the federal authorities and functionaries resident in the states and commissions specially appointed by the secretary of government; and (5) the sanitary agents specially appointed for any point in the republic.

For the local sanitary administration, the states have the ample liberty which the constitution guarantees them, and the code only establishes regulations for the federal district, and for the territories of Tepic and Lower California.

In the federal district, the sanitary administration is under the charge of the secretary of government and the supreme board of health, with all the expert employés that may be necessary. At present the board is composed of seven medical sanitarists, five being civilians and two military physicians, with one lawyer, one veterinary surgeon, one chemist, and one engineer, all of these being members. There are also one general secretary with seven employés, eight medical sanitary inspectors for the eight wards of Mexico City and four for the prefectures of the federal district, one inspector of provisions and liquors with eight subalterns, one man in charge of the bacteriological laboratory, one chief of the disinfection service with seven subalterns, and one treasurer. Outside of the federal district there will be two sanitary inspectors for the federal territories, with three physicians and three veterinary surgeons as delegates in the ports and frontier towns, the whole being subordinate to the supreme board.

We thus find in the sanitary administration a well defined scale of graduation, which begins with the lowest municipal employé and rises up to the department of government, whilst the supreme board of health acts as a consulting body and an executive expert.

The federal sanitary legislation treated of in the first volume deals with the following matters:

Chapter I. Maritime Sanitation—Article 1. Ports;—Article 2. Lazaretos (Quarantine Stations).

Chapter II. Sanitation in Frontier Towns.
Chapter III. Sanitation in the States.
Chapter IV. Medical Statistics.

For the sanitary service of the ports, in the principal ones a physician will be established as president of the respective commission, which will be formed of the said physician, the captain of the port, and delegates from the local municipality.

In anticipation of future international reciprocal treaties, it is further provided that all Mexican ships bound to foreign ports shall carry a medical man on board, who will be answerable for its sanitary condition.

The ships which leave foreign ports bound for Mexican ports will be obliged to provide themselves with a clean bill of health from the Mexican consul of the port they sail from. These documents will be examined by the sanitary commission on arrival of the ship, and in case of necessity the commission will impose the quarantine deemed necessary for the prevention of contagion.

The same sanitary commission will have to visit every ship leaving a Mexican port, and issue the required bill of health, from which no Mexican ship will be exempt.

The second chapter of the first volume treats, in the first place, of the manner of avoiding the propagation over the frontier of any infectious disease which may appear in a neighboring country, such as Asiatic cholera; for which object they will establish quarantine stations similar to the maritime ones. This service will be taken charge of by sanitary commissions similar to those in the ports, and like them presided over by a physician who will be named by the secretary of government.

The same chapter continues, treating of the precautions to be taken to prevent the introduction of foreign cattle or meat which may be in a condition to transmit disease to men or animals; and also to prevent the exportation over the Mexican frontier of animals or meat which might carry the contagion into a foreign country of a disease acquired within Mexican territory. In all such cases the animals or meat will have to be carefully inspected by the veterinary surgeon.

Chapter 3 deals with the measures to be taken for the prevention of the spread of epidemics from one state to the other. For this purpose measures will be taken to isolate and disinfect the districts attacked, as well as for the most extensive vaccination of the people.

Chapter 4 provides facilities for the formation of medical statistics, which will be taken charge of by the federal sanitary officials, who will collect the data from all other federal offices, such as the civil registry, public and private hospitals, and physicians with legal diploma.

The second volume treats of the local sanitary administration, which is subordinate to the executive of the Union, and is divided into three chapters,—the first referring to the capital of the republic; the second referring to other points of the federal district; and the third referring to the territories of Tepic and Lower California.

The said first chapter, treating of the sanitary administration in Mexico City, comprehends the following subjects:

1. Dwelling-houses and schools.
2. Food and liquors.
3. Churches, theatres, and other public meeting-places.
4. Factories, industrial establishments, deposits, and other establishments which may become dangerous, unhealthy, or inconvenient to the public.
5. Sale of medicines and other substances of industrial use in drug stores and other similar establishments.
6. The exercise of the medical profession in all its different branches.
7. Burials, exhumations, and removal of bodies.
8. Infectious and contagious diseases.
9. Epizootia and sanitary precautions with respect to animals.
10. Dairies, slaughter-houses, and meat from the country.
11. Markets.
12. Garbage-dumps.
13. Public works affecting hygiene.

All these chapters deal with their separate subjects in the most detailed manner, and elevate the rules which are strictly demanded by the public health into legal provisions.

For the sanitary administration of other parts of the federal district outside of the capital, and of the territories of Lower California and Tepic, the second and third chapters provide for the adoption of the rules provided in the previous one so far as possible, taking into consideration the difficulties to be contended against in those places and not found within the capital.

The third volume treats of the penalties for infractions of the law, and in chapter first establishes general rules clearly defining the great difference that exists between faults and misdemeanors, in order that the latter should be submitted exclusively to the tribunals, and the former should be brought before the sanitary association authorities.

The fourth volume contains the proceedings for the application of penalties.

For the penalties applicable in case of misdemeanors against the public health, the Sanitary Code refers to the existing laws.

In treating of ordinary faults, it refers to the article 341 of the code of criminal proceedings of the district, according to which the penalty is imposed by the authority indicated in the respective law or regulation, or by the local political authority, or by the official charged with the immediate care of that department of the public service. According to the same article, every penalty that exceeds a fine of twenty-five dollars, or ten days' imprisonment, can be revised by a superior officer.

The board assumes this character of superior officer with respect to the revision above spoken of, and such revision will be conducted in full

meeting. When the resolution of the board is not in accordance with that of the inferior officer, the accused can appeal to the department of government.

The higher sanitary officials are authorized to place under arrest any individual accused of acts prejudicial to public health, and to enter into dwelling-houses, factories, and commercial establishments whenever their official duty requires them to do so. The simple sanitary agents cannot make either an arrest or a visit without a written order from the political authority, from a member of the board, or from the department of government.

The new organization of the Supreme Board of Health of the Mexican republic can be thus summarized:

1. The Sanitary Code emanates from the congress of the Union, and not from the executive authority.

2. The sanitary employés are well paid, and their positions guaranteed.

3. These same employés exercise their functions independently of the administrative police, which in sanitary matters is subordinated to the first.

4. Severe penalties are provided against all who in any way prejudice the public health.

5. The board declares these penalties, and puts them in force.

These are, gentlemen, the most important points of the sanitary code of the United States of Mexico, and we are certain that they do not fall very short of the degree of advancement to which we are certain to arrive, and for which we find a model and an example in your own laws on the subject; and at least we may feel convinced that within the Mexican frontier the subject of public sanitation has begun to assume the importance that it deserves.

VIII.

THE SEWER SYSTEM OF KANSAS CITY, MISSOURI, AND GENERAL COMPARATIVE SANITATION.

By E. BUTTS, City Engineer,

Kansas City.

There is not, in all that goes to make a city, an item of more importance than that of drainage. It is manifest in the little village, and continuously increases until a city is the result of a collective population. To the ordinary individual, this importance is not manifest until disease and death have visited his family *via* one of these gaseous avenues, when his eyes are opened to the facts after he is dispossessed of fifty per cent. of his worldly possessions; so he packs up the balance of his effects and moves to another locality, leaving the old for another to repeat his experience. Accordingly the mortality of the city is recorded, and the stranger seeking a home moves on to what seems to him a better clime. Here we have an illustration showing that from improper drainage not only the health but the prosperity of the city is affected.

The sewer system of Kansas City is not unlike that of other cities where the combined system of sewers has been adopted. Whatever may be found faulty here may be found generally so elsewhere, and also advantages found elsewhere will be found here, being the outcome of report exchanges, a medium of great advantage compared to expenditure of production.

Unfortunately for Kansas City, it is necessary to convey a portion of her sewage west through O. K. Creek valley, thence north to the Missouri river, and thence it passes along the north side of the city in an easterly direction. The drainage area of O. K. Creek valley being 3,000 acres, when thickly populated, would, no doubt, seriously impair the health of the city if permitted to flow as it does at present. Already some bad effects have existed during low stages of the river, or continuous absence of rain. The sewer system of the city, if carried out as anticipated, will obviate this difficulty by conveying all sewage of the city about three miles east of the city limits, constructing intercepting sewers which will convey the storm-water to the river at such points as may be deemed necessary and advisable.

In the combined system of sewers, the mixing of sewage with storm-water and discharging both by outlets leading to the river, when the flow gets above a certain elevation in the sewer, may seem to some a serious objection; however, there are some items which circumstances have made

which act as a preventive to the formation of carbonate of ammonia and other volatile gases which bear the germs of disease into the atmosphere. In order to form this gas, it is necessary for a contact with the atmosphere. By the addition of storm-water, a less per cent. of sewage is exposed to evaporation in proportion to the increased depth of the flow; also at the time when these outlets are being utilized the flow is more rapid than at any other time on account of their being used only during storms of magnitude sufficient to raise the flow to the outlet; the sewage portion of the sewer at this time is also being used to its full capacity.

The problem of sewage disposal of Kansas City is not a difficult one, barring, perhaps, the disposal of O. K. Creek drainage and the financial impediment. This latter is an obstacle encountered by all cities, a cloud now hanging over some of our first cities which will probably be dispelled by "heroic measures," and which should be dispelled before such measures are necessary.

The variation in the elevation of the river which forms the outlet to our sewer system being twenty-five feet, would also seem to be an obstacle to good drainage, as we have somewhat over 28,000 lineal feet of sewers now constructed below an elevation of twenty feet, our city directrix being nought at about low water, these sewers ranging from one to six feet in diameter. In this respect very little or no trouble originates, and in fact all the difficulty encountered is from the small gradient, as heavy débris gets into the sewers from the upper territory and steep grades of unimproved streets, which the current fails to move on the lesser grades of the bottoms. This frequently stops the lower sewers, and is quite an annual expense in maintaining the sewers, as well as a temporary injury to the health of the locality; but this trouble is being considerably lessened by the increase of paved streets and other improvements in progress.

An error generally made by cities is the first construction of sewers with capacity insufficient for proper drainage. These errors arise mostly from the calculations being made for the present, and not for conditions of the future, as the drainage is much more rapid on improved streets than on streets with a natural rough surface. There is also a tendency to underestimate the rain-fall on account of economy of sewer construction.

The sewers of Kansas City are calculated for the disposal of a rain-fall of two inches per hour for small areas, which is equal to the heaviest recorded rain-fall, and all sewers with this capacity have been sufficient for all purposes. In calculating for large areas, one inch and a half rain-fall per hour has been used, for the reason that a longer time is necessary for distant drainage disposal in the main sewer.

Corporations are frequently a great factor in the health of a city, as establishments such as packing-houses, desiccating-houses, ordinary slaughter-houses, etc., should be located where drainage facilities are best; unfortunately, so far as our city is concerned, this matter has been somewhat overlooked, as many of the establishments which should

have been located along the river below the city have been located above the city, some of which drain into the Kansas river, a stream which at low water has but a very slight current, and is at times covered with a scoria of such a nature as to considerably criticise the selection of the location of the establishments utilizing this river for drainage purposes. However, it is but a question of time when these sites must be vacated, or a great amount of money expended in the construction of sewers which will deposit the sewage where it should have been originally deposited.

One of the most important items for the maintenance of health is that of proper plumbing. The city employs a plumbing inspector, whose duty it is to inspect all connections or repairs to either water service or sewer pipes. This method of procedure works very well except in the matter of repairs, in which case there is a tendency to avoid procuring permits, and also avoid the plumbing inspector. This is done generally by plumbers who do inferior work, as the doing of the work that would stand inspection would necessarily be more costly, and the party doing the work would get no more for it. In the matter of repairs, there should be some method by which repairs should receive the same attention as new work, as, so far as health is concerned, it is of equal importance finally, and more difficult, to secure from old work the same results.

As to the method of trapping sewer gas, it is safe to say that of the thousands of patents there are none that give entire satisfaction. Of course it is difficult effectually to shut off all escape, but most of the traps in use are not substantial, and consequently easily get out of order, or otherwise fail to accomplish the intended result, the condition of which is not known until the atmosphere is offensive to breathe; in the meantime the air is impregnated with infectious matter insufficient to make itself known to our faculties, while it still produces diphtheria and similar diseases.

The traps in use in most cities, and in fact one might say without exception, for street catch-basins, are still more open to criticism, as there are times when there is no obstruction whatever to the escaping gas. What is known as the water seal trap is mostly used. This trap consists of a body of water retained in the bottom of the basin. During continued dry weather it evaporates to such an extent as to leave the end of the sewer uncovered, and consequently gas escapes freely. The remainder of the water in the basin, by stagnation, adds a per cent. to the injurious air. Of this style we have in Kansas City over 800. The more recent pattern used in the city consists of placing a swinging trap in the end of the sewer below the paving. The objection to this trap is, that when out of order it is necessary to remove the pavement before repairs can be made, and frequently a small stick or stone will lodge so as to hold it open and so temporarily destroy its usefulness. Of this pattern there are in the city over 500. There are also over 100 basins in the city which have no traps (these were the first constructed), making in all 1,400 basins. The basin in use at present in the city consists of a trap and cover com-

bined. This brings the trap to the surface, and should it get out of order it can be seen at once and adjusted without difficulty.

All catch-basins should be as tight and as impervious to gas as possible, sufficient ventilation being obtained through the man-holes.

The sewer system of Kansas City consists of ninety-eight miles of sewers, 1,400 catch-basins, and 2,100 man-holes. The sewers are divided into four classes, viz., public sewers, district sewers, joint district sewers, and private sewers. The public sewers are paid for out of the public funds; the district sewers are paid for by the property-owners within the drainage territory where constructed; joint district sewers are paid for by the property-owners within the districts, where constructed collectively. This provision is a very wise one, as by it the cost of constructing a large sewer for the outlet of adjacent districts is distributed equally through all districts benefited. The fourth class includes all private sewers which are connected with the public or district sewers.

The city is divided into five sewer divisions. Each division carries the drainage of a creek valley or a portion of the river valley, and all sewers constructed in these divisions are provided with a terminus as aforesaid in the Missouri river east of or below the city. The sewer system also provides that if at any time it is decided to construct a tunnel or tunnels for the conveyance of sewage, such construction shall not be construed as to conflict with the sewer system of the city.

The proposition for tunnelling from Grand avenue and Twentieth street north-easterly to a point near Gillis street and First street, a distance of nearly two miles, for draining O. K. Creek valley, has been considerably discussed by engineers, as also has a proposition to drain the valley to the east against its natural course. As to carrying out these propositions and similar cases in other locations, the difficulties are not apparent to the general observer. In the cases above, to tunnel north-eastwardly from Grand avenue and Twentieth street to Gillis and First streets, the cheaper of the two propositions would require an expenditure, to drain O. K. Creek valley, of nearly $1,000,000, also involving the construction of the same lateral sewers that have been built and are now being built, the cost of which amounts to nearly another million dollars.

There is a line in sewer construction which is located somewhere between the value of the property, the drainage area, and the cost of the proposed sewer construction; and in some cases, when the location of this line is ascertained, it shows that rather than construct according to the proposition, it would be a matter of economy for cities to purchase, depopulate, and utilize the ground for other purposes.

IX.

THE RELATIONS OF THE PLUMBERS AND THE PHYSICIANS.

By ANDREW YOUNG,

Chicago, Ill.

Mr. President, and Gentlemen of the Convention: In bringing before you the subject of the present occasion, I do so because the plumber and the physician are not what they were. The advancement made by the plumber in the last decade outstrips all other reaches made in the scientific directions of his trade. In scientific direction, in mechanical skill, in the whole work that goes to make up plumbing, he does not stand to-day in the shadow of where he stood ten years ago. The manufacturers of plumbers' supplies have had to adapt their output to meet the demands of the last decade, as if they were making products for a new class. The old closets, fixtures of all kinds, old pipes, and the plumbing material of all kinds have so changed that if any one were now making the old kind he would have no market in which to sell them. There are plumbers at work to-day who have never known the use of the old plumbing fixtures, and let us pray they never may. We have advanced with remarkable strides since we learned the relation we sustained to sanitary science or preventive medicine. We found we were doing work that was unventilated, that was so situated that it could not help but breathe up the sewer gas and breathe it out in the rooms of the houses, without there being any kind of a remedy put forward. We toiled on in this way, hard work as it was, and while we felt that we were not doing the best for the household, who were going to give us a better means, and bring us out to this brighter and better day?

Plumbing is no longer a mere trade. Its importance and value in relation to health, and its requirements regarding scientific knowledge, have elevated it to a profession. It is clothed with the responsibilities of the learned professions and the dignity of the sciences. The high qualities of mechanical skill are combined with the knowledge of the best sciences of the most practical utility. It unites skilled labor and high educational qualifications in one. This being the nature of plumbing to-day, it becomes the duty of the plumber to maintain in every way the dignity of his high calling. It should be his special care to have the profession as free as possible from the deleterious effects of the incompetent and unscrupulous. He cannot afford to have the high position to which plumbing has attained tainted by the ill influences of the unworthy and

unqualified. The results of his labors, in every instance, should be added evidence of his skill and capacity in meeting the demands of the highest and latest approved requirements of sanitary science. He has a responsibility that rests upon none other. To a great extent, the healthfulness of our homes and the vigor of our country depend on the character of his work. This responsibility gives to the plumbing profession a dignity and importance that attach to few others, and places upon the plumber the duty of qualifying himself to maintain, under all circumstances and conditions, the dignity which public sentiment has placed upon him, and which his position among the learned professions demands.

The day of the tinker and scrimper is happily passed. Out of the labors and influences of the National Association of Master Plumbers has come a new era. The relations of trade interests, legislative councils, boards of health, sanitary officials, and the public generally, have changed with respect to plumbing; and the plumber, always in the advance in these great interests, was ready to meet the higher obligations and demands of his profession. Through the efforts of plumbers, the fraternity is being freed from the bad effects of the incompetent, and have, to a great extent, surrounded themselves with a penal code, rendering work performed, not up to the established standard, an act punishable by fine. They have at all times taken the lead in matters which have resulted in material good to the public in the promotion of public health.

I remember when I was chief inspector of the Health Department of Chicago, that it dawned on me that the houses erected ten years ago in that city were not in a sanitary condition. Their plumbing was unventilated, old fixtures were in place, and everything in them, from the sewer to the water-pipes, was in a filthy and choked condition. Sewer air could easily enter the rooms of most houses then built, and, in several, it had made its entrance felt to a fatal degree. But why had come this change? Why were the new houses going up in Chicago so changed in their internal arrangements and made so nearly hygienic, so far as the plumbing was concerned? There had been a great growth. Every man in the plumber's trade, who betook upon himself the advancement of his trade, had done something. The word went forth that the houses were not in a sanitary condition, that they lacked proper plumbing, and that they were the ones looked upon to furnish a proper plan of sanitary plumbing. Step by step, the progress was made; round by round, the heights were climbed,—until to-day, in all of our cities, there is the plumber and there is the material ready to arrange any man's house in accordance with the latest and best advices of sanitary science. We are not going back over this ground again. We have travelled it once; but now, having got out of it into the clearer light of intellectual handiwork, we propose to keep plumbing up to its highest marks of excellence. If the next ten years mark the progress the last ten years have in the plumbing trade, we propose to keep right along with it, up with it, doing the work as inven-

tive skill may mark it out for us to do. But I do not expect to see the manner of ventilation, which has done so much for the hygienic arrangement of houses, set aside for any other means. It has come with other good plumbing arrangements to stay, and to keep the plumbing in the houses fresh and sweet; to keep the sewer air in its proper place and take it out upon the tops of the houses; and to keep every fixture of the best class that inventive genius can produce.

I need not take up time in asking what you have done. Your work speaks all along your path. You have had no easy way, for opposition is met with everywhere. We have not all the plumbers with us, nor have you all the physicians with you. But we both have enough so thoroughly imbued with the great plan of preventive medicine that we can now begin to talk of the relations of the plumbers and physicians. I do not believe you think that we are of no concern to you in your work. If I did, this would not have been written. But as I have been for the past two years delivering lectures before the Chicago Medical College on the subject of house plumbing and drainage, I find that the subject is one of great interest to them, and the kind invitation I received to deliver this, makes me know that we stand in close relations, and that we might make them closer, without the possibility of doing any harm but a great deal of good. There are many ways in which the plumber could be of benefit to you without infringing on your labors or on your profession. When you have a case of sickness on your hands, and it is not clearly defined, let it be the first thing you do to get a proper plumber to inspect the house, and see if it is in a strictly hygienic condition. I say let a plumber do this, for then it will be done correctly. It is his business to know when the plumbing is done properly. Whenever you are called in to see a patient, unless you are quite sure that the house is in an entirely sanitary arrangement, get a plumber to do the inspecting, and he will soon tell you whether it is all right or not. It is a sad case to see what I have seen in this city. The physician working hard, with all his energy, on people whom he could not tell what was the matter with them, and fearing for their safety. The plumber would go into the house, inspect it, and tell the doctor that the house was in a most wretched sanitary condition. The patient would be removed, and in time would get well. But it is a slow process where he is filled with poison until he has to go to bed with it. When the poison gets that far along with a man, he is in too critical a place to prevent all being done that could be done for him. If, then, the plumber is called in and finds the place unhygienic, it will be but a little spell to remove the patient into sanitary quarters. It is certainly not asking too much of you to ask you to do this. Many lives may be saved by it, and many long hours of pain prevented by it. The plumbers will not tell you what to do with your patients when they are found in unhygienic places. He presumes you know what to do, as you do. But let me impress upon your minds to-day, that you have the houses inspected by the plumber, and make yourself sure it is all right or that the plumbing is out of repair. Do not depend

on your own inspection, unless you are a plumber and know that you understand the system of to-day. I may be pardoned for believing in every man to his trade. It is a good rule to work on, and I have found it out to my heart's content. You are no plumber; you are a physician, and follow that as a profession. No plumber lies in bed sick without sending for you. You are his first thought when he is laid up from his labors, and when you call to see him, have his house inspected by another plumber. Do not rest satisfied until you are thoroughly convinced that the house in which you have a patient is in a thoroughly sanitary condi tion. If not, get to work getting it in such a condition so soon as you can. Let the plumber who has discovered the defects set about them and straighten them up. It may not be more than a leak or so, but that may be enough to take your patient off, despite all you can do. The curative method is sometimes simple, and the simpler it is the better. If the man needs fresh, pure air, let him have it. Let the foul air of his room out, and the pure, sweet air in.

The sewers of a house must have lungs to breathe through, or they will breathe in every room in the house. The method of ventilating them will furnish them with breathing-power, and all the time they will have fresh air going up and down the stack. It was a wise provision, when in the plumbing system it was found that ventilation-pipes could be constructed so that fresh air would be ready at any fixture, so that when it was operated it would flush the system to the sewer and then stand open for the sewer to breathe through. Who should know when this is done right, if not the plumber? Who is skilled in this work, better qualified to judge, than the man who has followed it all his life? I am probably wrong, but I will risk the plumber many times over any other person I know, and when he gives me his investigations, I can accept them as being correct.

Protective medicine will not be secured by the physician alone, but by the coöperation of the plumber. The plumber has it in his hands to make dwellings unsafe for man, or so that he cannot live in them at all. Should the plumber be so determined, there is a great amount of mischief which he could do, and no one be the wiser. But the day is passed for that. It is his highest duty to study his work and make improvements upon it. Where he does not come up to his highest ideal of his class of work, let him study it until his ideal is reached, and all will be well.

If five thousand cases of typhoid fever in Chicago, or any other filth disease, were taken as a case, let it be borne in mind that every unventilated sewer system is directly in communication with where the diseases are prevalent. In many cases, imperfect connection with ice-boxes brings the food of the family in direct communication with the gases from the street and house drains. That sickness should result is not to be wondered at. Every agency for its growth is thrown open, and if it does not go forth to bring down its victim, something is entirely wrong.

Nor can all architects be trusted in this most important matter of house drainage, by reason of their lack of knowledge of this most essential

service. Taken in consideration, the imperfect work devised, superintended, and accepted by them in the past, would give but little hope for the future, save in the employment of the practical man skilled in his profession.

There is one particular in which I might ask you to give us your aid. These cities, many of them, cannot be inspected in regard to their drainage and plumbing, as they are now. They stand without laws regarding this, and it is our desire to have laws passed giving us the right to inspect them. In this you can aid us. The family physician, his word is potent in the house. What the patient shall eat, drink, or wear is at his dictum. And, while advice from the plumber might be looked upon by the owner as having a selfish bearing, a word of the medical man as to an improvement of the sanitary condition of the house would be unquestioned, and his advice readily complied with on the part of the owner. So that co-operation on the part of the gentlemen of the medical profession will do wonders in the great cause of preventive medicine.

X.

THE DRAINAGE OF MEXICO CITY.

By ROBERTO GAYOL, C. E.,

City Engineer and Engineer of the Board of Health,

City of Mexico.

GENERAL TOPOGRAPHY AND HYDROGRAPHY OF THE DISTRICT.

The City of Mexico is situated near the lowest point of the large, flat valley of the same name, enclosed on all sides by mountains, which are of great altitude, on the eastern, southern, and western sides; but on the north the range presents a great depression, which only rises to an elevation of two hundred and fifty feet above the mean level of the city.

This valley contains three natural lakes, namely, Chalco, Xochimilco, and Texcoco, and three artifical lakes, called San Cristobal, Xaltocan, and Zumpango.

Lake Texcoco is the lowest in level, the most extensive, and the one that receives the refuse of the city, besides a very large share of the rain-waters falling within the water-shed. Its waters are strongly impregnated with salts, amongst which carbonate of soda predominates, as the mountains surrounding the valley contain a great deal of feldspar. These salts keep the water of the lake in a healthful condition, although for several centuries it has continuously received the refuse of hundreds of thousands of human beings.

The bottom of the lake has naturally risen in the course of years, and at present it is only six feet below the mean level of the city. This difference of level was the only means of giving a current to the sewage of the city, but it notably decreased not only with the rising of the bottom, but also with the rising of the water from heavy rains, often causing a general inundation of the streets of the city.

To remedy these evils the main drainage works were projected many years ago, and their location can be seen in the general map of the valley. This project includes the opening of a canal thirty miles in length and of a tunnel six miles in length, but their execution was for many years delayed by political disturbances and want of money. The work is now being actively pushed forward, and with such activity that the monthly extraction of earth from the canal amounts to nearly 300,000 cubic yards, whilst the tunnel is pushed forward at the rate of six hundred lineal feet of finished work in the same period. These figures will increase in the near future; and, taking into account the work already done and what is before

us, there is no doubt that within thirty months, more or less, the waters of Lake Texcoco will be drained off, thus freeing the capital of the republic from a danger that has threatened it for many years. The salts, also, which for thousands of years have been accumulating, will be dragged to one point, the mouth of the tunnel, which is situated at an elevation of seven thousand three hundred and ten feet above the sea level.

From the very magnitude of these works their execution is necessarily slow; and to be able to facilitate the removal of sewage and storm-waters with rapidity, I established three years ago four centrifugal pumps with a lifting power of seventy-six thousand gallons of water per minute to sixteen feet elevation, at the same time isolating the site of the city by means of a dyke circumvalation that impedes the entrance of waters from outside. I established these pumps in such a way that by their means it would be possible to lower the waters in the interior of the city to the same depth to which they would fall with the general drainage of the valley; and this circumstance allows us to commence the construction of a net of sewers on a definite plan, and in accordance with the principles of modern sanitary science.

In order to commence this construction, it has been necessary to study a general plan in all its details; and this study is what I have the honor to present, giving an extract of the report which I presented to the city council of Mexico City.

SKETCH OF A PROJECT FOR THE DRAINAGE OF MEXICO CITY.

System to be Adopted.—In order to determine on the best system to be adopted for the sanitation of the city, I made a careful comparative study of all the known systems and of the circumstances under which they are generally applied, as well as of the condition of our own capital, so as to be able to see which, under the circumstances, would be most applicable. The extension of this article will not allow me to enter into all the considerations that induced me to adopt the system on which I am now reporting, and for that reason I limit myself to a description of the system determined on, which is called the Water Carriage Combined System. The conditions which determined its use are as follows:

1. That it is necessary to drain by means of sewers the large quantity of storm-waters which are precipitated in extensive and densely populated districts, such as are found in great cities, and that it is therefore necessary to construct a new system of sewers with this object.

2. That it would not be necessary to purify the sewage, or, at any rate, its purification would be an easy matter, and it would not contaminate the supply of drinking-water.

3. That an abundance of water should be available to flush the sewers.

The first condition is found in Mexico in all its details, as it is an extensive, densely populated city, and it is absolutely indispensable to construct new sewers to give an outlet to the sewage and the storm-water, as neither

PROPOSED PLAN FOR THE DRAINAGE OF THE CITY OF MEXICO: ROBERT GAYOL, CITY ENGINEER.

one nor the other can be allowed to run on the surface of the streets, because, besides the many inconveniences of such a system, there is not enough fall on the surface to produce the necessary movement in the liquids. Besides this, the pumps which I established have produced such changes on the hydrography of the city—which changes will be continued and made permanent by the general drainage of the valley—that it is necessary to reconstruct the whole system of sewerage, and destroy the existing sewers, which are very defective, and cannot possibly be brought into the new system.

The second condition is also realized, as the sewage at present goes to Lake Texcoco without any inconvenience, and later on will go to the other side of the valley to the outlet before mentioned, at an elevation of seven thousand feet above the sea level; and the purification will be made by the intermittent filtration of the sewage, which will be utilized in the irrigation of the immense extension of farming lands below the mouth of the tunnel, and which cover several thousands of square miles. Neither is there any drinking-water to be contaminated, as the current which it is proposed to create does not at present exist.

The third condition can be realized in Mexico in so complete a manner, that doubtless there are very few cities in the world that have such good facilities for flushing sewers. For this object we can count on the water in the lakes of Chalco and Xochimilco already mentioned, and which can supply during the whole year thirty-five thousand gallons of water per minute. This water is not drinkable, but it can be used very well for flushing the sewers, and can be conducted to the highest point of the drainage system.

These conditions are general, and applicable to any city; but we have here another one worth considering, which is, that now as well as in the future the storm-waters and sewage must mix, either in the lake of Texcoco, or in the drainage canal now in construction; and it is not worth while to undertake any work to separate elements which eventually must mix, nor ought any sacrifice to be made with that object.

It is therefore clear, that in Mexico an excellent application can be made of the Combined System, while there is not one single reason for the establishment of the Separate System, or any other; there is no doubt possible on the subject, and therefore I came to the following conclusion: To obtain, in Mexico, the most advantageous sanitary system at the lowest possible cost, *The Water Carriage Combined System* ought to be established; that is to say, that the sewers or conduits must be conveniently arranged to receive the liquid refuse of the houses, the house sewage, the storm-waters wherever necessary, the subsoil water, and, finally, the refuse liquids from industrial establishments.

Topography of the City.—The general plan of the City of Mexico, which I present with this paper, shows the contour lines at twenty centimetres apart (approximately eight inches). These contours show that there are several places where the ground is lower than the general average and

that the differences of level are hardly perceptible, that there is a slight fall from west to east, and that there is no talweg or natural line of drainage.

These special conditions show that it is impossible that the liquids should run on the surface of the ground, and that for the same reason it is necessary to construct sewers to receive them; that it is also necessary to give these sewers the fall which they require, increasing the difference of level by artificial means, either by pumps, as at present, or by the drainage works of the valley; that this fall must be established from west to east; and that the arrangement of the sewers on the plan must be fixed by considerations independent of the topography, as this does not oblige us to establish the main sewers precisely on any determined line.

Alignment of the Sewers.—The last circumstance referred to in the preceding paragraph will allow a great many different combinations, whose advantages and disadvantages I have carefully studied and compared.

We could, for instance, at once determine on concentrating the whole of the sewage in one single main, running through the centre of the city, but this main would require to be of an enormous size at its lower end, thereby greatly increasing the cost of construction and the difficulties incident to its passing through many narrow streets; besides which, during the rains the water would rise within the sewer, very much decreasing the hydraulic grade and, consequently, its discharging capacity, and, lastly, it would increase the importance of the lateral sewers, diminish their fall, and also increase the difficulty of cleaning out the whole system.

For these reasons I have found it more convenient to divide the city into five districts by means of lines whose general direction is east and west. On the central longitudinal line I propose a main sewer, and on the division line between each two districts I would have another sewer, which would at the same time receive the sewage and distribute the water for flushing the lateral and main sewers; and to these sewers I have given the name of distribution sewers. Branching off from these, there will be other sewers of small section called the lateral sewers.

In the arrangement of these sewers I strictly follow Lindley's principle, avoiding by all means *dead ends*, in order that every point in the system should be reached by an abundance of water which would clean the sewers and carry off any deposit. In the construction of these sewers, I also strongly recommend the principles laid down by Rawlinson.

In the general plan of the city I show the arrangement of all these sewers, as well as their fall in thousandths and ten thousandths, their section by the diameter in centimetres, and their length in metres between their points of junction or bifurcation. This excuses me from entering into detail touching these points.

Depth and Fall of Sewers.—The level of the lateral sewers is established by the fact that the system of flushing requires that the water shall

Sketch Map of Part of the Valley of Mexico, Showing Location of Main Drainage Canal, &c.

reach them through the distribution sewers, passing through them and discharging into the main sewer, the lateral sewers thus forming an artificial talweg through which the waters of each district would have to flow; and for this reason it is clear that the distribution sewers ought to be placed at the highest level on corresponding points in a north and south direction.

The general fall of the whole system of drainage is naturally established as from west to east, being so prescribed by the circumstance that the natural fall of the ground is in that direction.

The depth at which the sewers will be built at their eastern extremity, which is also the lowest, is determined by the level to which the waters will be reduced by the general drainage of the valley; and this level will be three metres above datum (nearly ten feet), while their western extremity is fixed by the highest altitude at which their commencement can be placed, bearing in mind the altitude of the ground which varies from nine to ten metres above datum (between thirty and thirty-three feet), and that the inverts will have to be placed in such a position that there will be only eighteen inches of earth over the sewer. Dividing this difference of level by the length, I obtain the very reasonable grades which are shown on the plan.

Discharging Capacity of the Sewers.—To determine the discharging capacity required in the sewers, I made a careful study of the rain-fall in Mexico, and I found that on an average of every two years a rain fell in Mexico at the rate of more than one inch per hour.

I had to take into consideration that all the best authorities in matters of drainage of large cities are agreed that it is quite unnecessary, and even very inconvenient, to adopt a system of drainage for the exceptional cases of such rain.

The special case of Mexico City presents less difficulties for providing for ordinary cases, as the ground is very level, and the water precipitated in different points of the city does not run on the surface and accumulate in other points, and hence the water can never do any serious damage. This fact is fully confirmed in practice, as the present system of drainage of the city only has the fourth part of the discharging capacity which the future system will have, and if some streets are partially flooded, the water never rises above a few inches.

Besides the above, there are other important considerations to be taken into account, and one is, that the drainage canal can only pass sixty thousand gallons of water per minute, a circumstance which I will take into further consideration later on.

The magnitude of the data and information on which I founded the conclusion that I had to deal only with the maximum of a rain-fall of one inch per hour, prevents my giving it here in full, and I can only record the conclusion to which I arrived.

To determine the amount of water which reaches the sewers, I employed the formula of Burli-Ziegler, and when once I knew by this the amount of

water for which each sewer ought to give passage in proportion to the area, I accepted, for determining the velocity, the formula which the drainage commission of Massachusetts derived from that of Kutter, and with these elements I formed the diagrams which accompany this paper, and by which it is very easy to form an idea of the dimensions which any sewer ought to have, when once we know the superficial area to be drained and the fall which it is to have.

By means of these diagrams the dimensions of all the sewers shown in the plan were calculated with the greatest ease.[1] The principal collecting sewers have an increasing section, while the lateral sewers vary very little in general, and that of the distributing sewers not at all.

These differences arise from the fact that the principal collectors increase the area which they drain as they proceed, while the distribution sewers discharge the whole of their water through each lateral into the main sewer. With regard to these lateral sewers, I had to bear in mind, besides the considerations of the capacity for discharging, the necessity that the velocity of the water should never be less than two feet per second, in order that the liquids should carry off the solid matters which always tend to form a deposit in sewers. This circumstance gives them in general a larger dimension than that which is required to drain the small surface which they serve, and for this reason their diameter would only have to be increased in cases where their length was very great. There is no difficulty about making them a little larger than what is strictly necessary, because by means of the water from the distribution sewers it is always possible to half fill the lateral sewers and flush them in the most effective manner.

Form of Cross-Section for the Sewers.—In all the cities where large drainage works have been undertaken, the system which has almost invariably been followed has been to give the sewers of small and very large section a circular form, and to those of intermediate size an egg-shaped section; and this practice, which is amply confirmed by experience, is that which I have thought best to adopt, endeavoring as far as possible to reduce the number of different types, thus facilitating the construction.

The circular forms vary, first, between thirty and sixty centimetres, and afterwards between one metre twenty-five centimetres and three metres. Those of egg-shaped form I determined should be of five distinct classes.

The circular form in the whole length of our main sewers does not present any difficulty, as they can be provided with an abundant supply of water all the year round.

[1] To Use the Diagrams.—Given, area to be drained and available fall on line of sewer. Entering diagram with given area to be drained (as 10 hectares), we obtain from the rain curve the discharge in litres per second (231 litres for 10 hectares). The intersection of the vertical line for the given discharge with the several curves for different types of sewer will indicate the necessary grade for each to produce the given discharge; and, conversely, the position of the intersection of the given vertical with the horizontal line for the given available grade (as .0009) will indicate the proper type of sewer (in this case No. 5).

Junctions and Conditions.—All the considerations that I had to bear in mind with regard to the manner of arranging the connection of the sewers, led me to establish the following rules as to the way in which such connections should be made throughout the City of Mexico.

1. Whenever two or three sewers make a junction in one point, the invert at the point of intersection shall be so constructed as to carry the cylindrical surfaces as far as is practicable. This practicable limit will be determined for each particular style of junction.

2. These junctions are to be covered with a funnel arch, or with any other arrangement that can substitute it if it is found more convenient on account of facility of construction or of economy.

3. The junctions will be made by means of curves of the longest possible radius when the sewers are of large or medium dimensions, locating them so that their centre lines will unite in a tangent; but if the sewer is of small dimensions, the curve of junction will be all within the man-hole.

4. In the case of small sewers, the inverts will be prolonged according to the system established in the first rule.

5. In every case it will be necessary to take care that the bottoms of the branch sewers have sufficient altitude to bring the level of the water within them to the same level as in the main sewer into which they discharge, assuming the height of the water in the latter as that which it would probably have during ninety per cent. of the time.

6. The house drains ought to enter the sewers at an angle of thirty degrees at least, and at a point above the ordinary level of the water within the sewer when it is not situated at any great depth, because, if it is, it would be convenient to make the entry higher up to facilitate the construction.

7. When two drains or small sized sewers meet in a man-hole opposite one to the other, one of the two ought to be pushed forward a little in order that when they are completely full their currents should not meet, as would happen if they discharged exactly opposite to each other.

8. At the time of constructing the sewers the connections for the house drains will be at once placed, and not only those which are to be immediately used, but also those whose necessity can be foreseen; and those which are not at once used will be covered, and a careful note taken of them in a special register, drawn in such a manner that whenever any one of them may be wanted, its exact position can be fixed without any trouble.

Man-Holes and Lamp-Holes.—For the man- and lamp-holes I followed the same method. Analyzing the practice which has been followed in the principal cities of the world, and applying it to the special conditions of the City of Mexico, I arrived at the following conclusions:

1. The man-holes ought to be of circular section, or of elliptical when they are placed in sewers of one metre or less in diameter; but those of a greater diameter ought to be of square section, although in both cases they

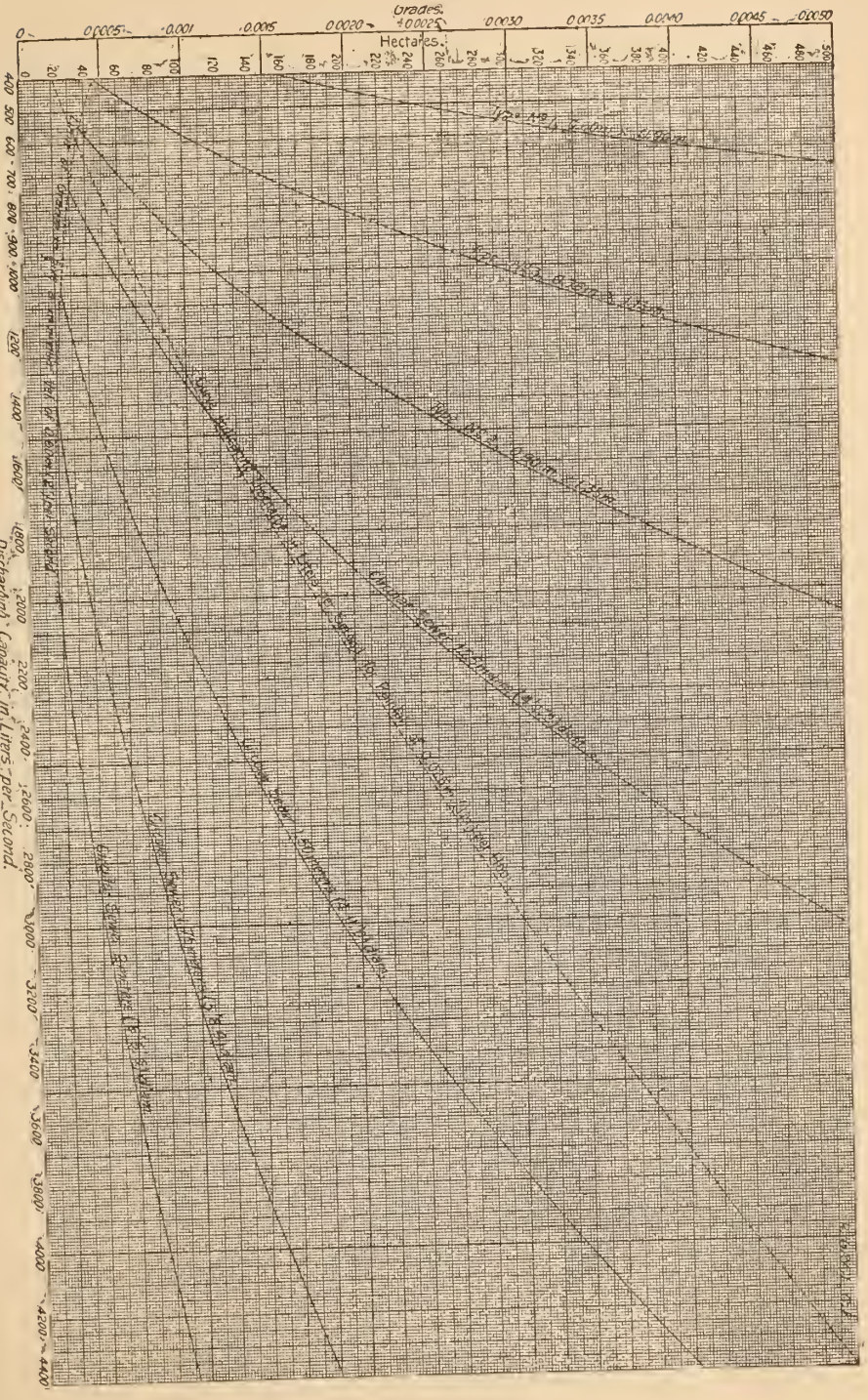

DIAGRAM 2. LARGE SEWERS.

would terminate at the level of the street with a circular aperture two feet in diameter.

2. The aperture above spoken of should have a cast-iron cover; this cover should be perforated throughout, but the holes on the periphery will be covered with small blocks of hard wood, leaving the holes in the centre uncovered for the ventilation of the sewers.

3. In case it should be shown by experience that the small amount of garbage which falls through the holes in the covers should give any trouble in removal by flushing, an iron-plate tub can be placed within the man-hole.

4. These man-holes should be placed at distances one from the other, which might vary between one hundred and sixty-five and five hundred feet, according to circumstances.

5. When the sewers pass under crowded streets or directly under a railroad, the man-holes will have to be connected laterally from the side-walk; but under all other circumstances the man-holes will be made directly over the centre of each sewer.

6. Directly over the sewers which are of three feet or less in height, lamp-holes will be constructed at distances not above one hundred and sixty-five feet.

7. At the point of any change in the centre line of the sewer, whether in alignment or in grade, there will be a man- or a lamp-hole, according to whether it is a sewer of large or small section.

Gullies.—With respect to the gullies, I studied an arrangement similar to that which they have in Frankfort, Germany, but making them shallower and without any trap, for the following reasons:

In Mexico we only have rain generally from April to October, so that if we established as a necessary condition that these gullies should be provided with a trap, it would also be necessary to give them an artificial supply of water,—a very difficult matter, and one that never could be properly organized; besides which, the water that happened to remain in the catch-basin would decompose, producing miasmas that doubtless would be more prejudicial to health and disagreeable to the smell than those of the sewer. For this reason I prefer recommending that they should be cleaned frequently, thus avoiding the necessity of large catch-basins and doing away with the trap.

In Mexico the thermometer never falls below twenty degrees Fahrenheit, and this only as a very exceptional case in the earliest hours of the morning; and on the very coldest days of winter the thermometer always rises to fifty or sixty degrees, for which reason it is perfectly useless to take any precautions against frost, and the water in the catch-basins will never freeze, however shallow it may be. On account of these and other considerations, I have set down the following rules for the construction of gullies in Mexico City:

1. The inlet shall always be in the gutter, and covered by a grating.

2. A catch-basin shall always be placed under the grating, and will be formed of an earthen-ware or iron tube.

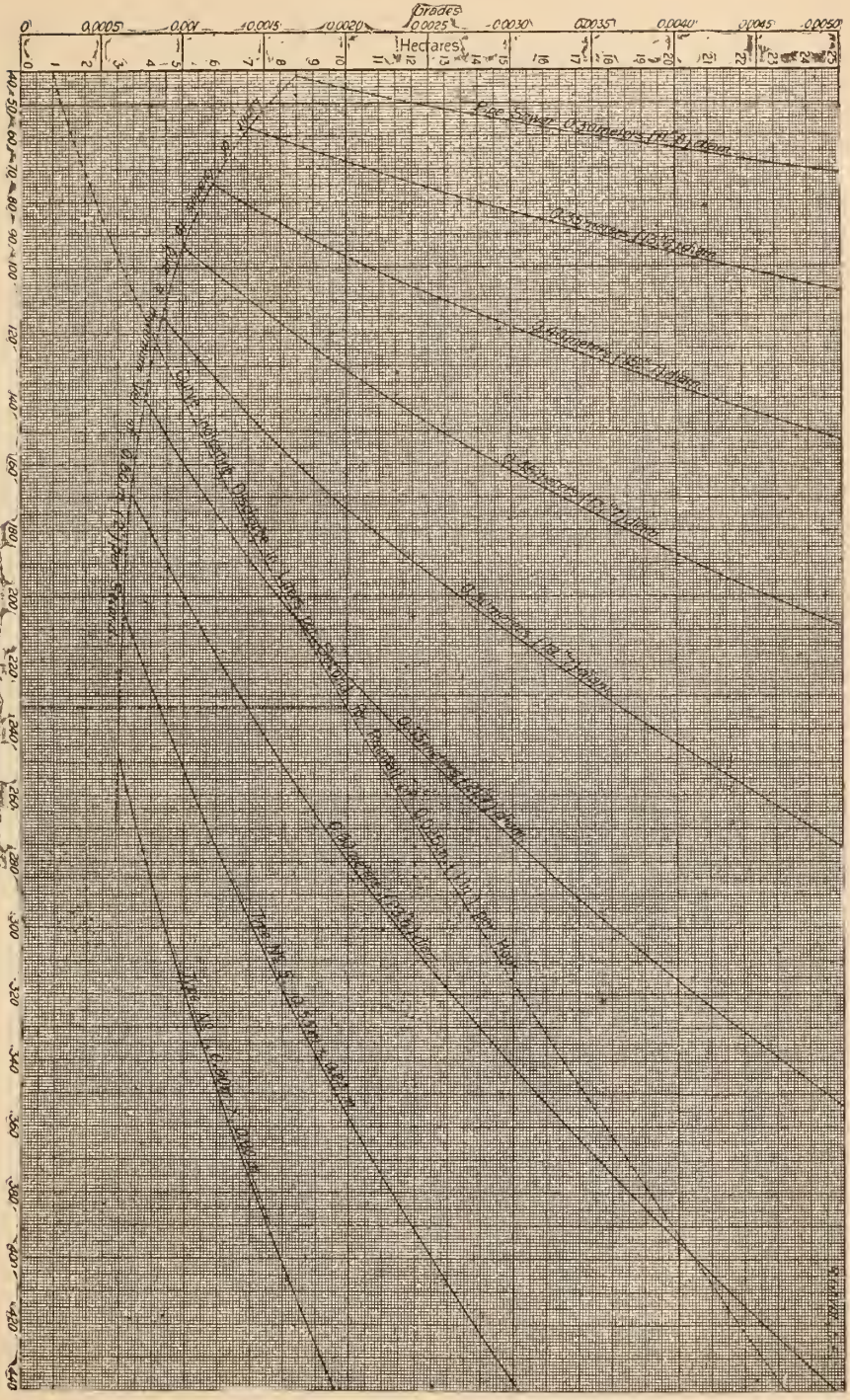

DIAGRAM 11. (SMALL SEWERS.)

3. None of these catch-basins will have hydraulic traps, as one of the rules of the maintenance of the system of sewers must be, that the catch-basins shall contain water only for a short time, and this especially in the dry season.

4. An iron bucket will be placed inside the catch-basin in order that the solid matters which ought not to pass to the sewer should be caught therein, and taken out with ease and rapidity.

5. The pipe to connect with the sewer will be of earthen-ware, and of six inches inside diameter.

6. Special care shall be taken that the man-holes, lamp-holes, and ventilation-holes shall be placed as near as possible to the points where the rain-water drains discharge into the sewer, with the object of preventing the sewer gases from escaping through the inlet of the gullies.

7. The gutters will be formed by the simple depression produced by the crown of the street terminating in the line of the curb-stone.

Ventilation.—In order to determine on the best manner of ventilating the sewers, I studied all the systems which have been employed in the world, and the conclusions arrived at by the Metropolitan Board of Works of London; and with these data I established the following rules:

1. The best system of ventilation to be used is that which communicated the sewers with the open air at frequent intervals, in order that there should be no point inside of them where the renewal of air would be in any way difficult.

2. This communication will be established by the man- and lamp-holes, by the gullies, and by special ventilation-holes, which would be constructed in the spaces between the others when the distance between them is more than one hundred and forty-eight feet.

3. These ventilation-holes will be of the same type, and they will have a diameter of ten inches.

4. The covers of these ventilation-holes will be of the same class as those of the man-holes.

5. As a general rule the sewers ought not to be ventilated through the house-drain, but rather a ventilation-hole ought to be built over the house-drain, thus obliging the gases to escape in that way rather than enter the house-drains.

6. In the distribution of the ventilation-holes over the length of the sewers, efforts ought to be made as far as possible to have them placed at the points where the storm-water drains connect, in order to avoid the escape of the sewer gases through the inlets of gullies.

7. The rain-water pipes from the houses ought never to be used as ventilators, and they ought not to have hydraulic traps, as these would not act except in the short rainy season; and the object of this rule is rather to show that these pipes can in no way be used for the ventilation of the sewers.

8. If any factory or industrial establishment, where a large chimney exists, will consent to the connection of its furnaces with the sewers so

that the gases can escape that way, the connection should be made, unless very expensive. Should the cost of this connection be very high it ought not to be made, because the advantages of this ventilation do not extend for any considerable distance, and therefore we should have to resort to other means at other points of the sewers where chimneys do not exist.

9. With the means at our disposal of flushing the sewers under the new system of drainage, there ought to be no escape of noxious or disagreeable gases, but care will have to be taken to clean out the sewers with due frequency, so that once established the presence of any bad odor will be a sure indication of the presence of accumulated matter and of the necessity of flushing the sewer from which it proceeds.

10. Under no circumstances ought the sewers to be ventilated by machinery.

Pumping Stations.—In treating of the discharging capacity of the sewers, I stated that the grand canal of the main drainage works has a capacity for the passage of only sixty thousand gallons of water per minute. This applies to the first twelve and a half miles, but beyond that point the same canal is so far enlarged that it can carry two hundred and twenty-one thousand gallons per minute, being made so with the object of draining Lake Texcoco.

In a rain-fall of one inch per hour, the city sewers will discharge this same quantity more or less, and at first sight it might be thought desirable to give the canal the same width in the whole of its length; but against this we must take into consideration that in the whole of the section comprehended between the city and the point where the waters of Lake Texcoco enter, the only liquids to be carried are those expelled by the city, and that during the greater part of the year these will be very scarce, and if the canal were too wide the solid matters would be deposited. In my opinion it would be a very unreasonable thing that we should thus, by means of our own sanitary works, establish a future nursery of infection that to-day does not exist.

The drainage of this city demands that the works shall be capable of giving an exit in a short time to a great quantity of water, while, on account of the sanitary requirements, these same works should only have the capacity that is strictly required to allow the passage of the water disposable at all times; and to satisfy these two conditions at the same time without sacrificing one to the other, I have proposed the establishment of pumps capable of removing the excess of water which the sewers carry during very heavy rains, and which would not find room in the canal.

These pumps would work only a few hours in the year, and therefore the cost of fuel, which in other circumstances is such an important factor in Mexico, is really not so in the case of the drainage, because these pumps would require to work only on the rare occasions *when the rain-fall exceeds three eighths of an inch per hour;* because when the rain is of less volume the water can escape without difficulty.

A careful study of our meteorological statistics shows that the rain-falls

of more than three eighths of an inch only amounted to two hundred and fifty-two in a period of fourteen years, that is to say, an average of eighteen for every year. In the majority of these cases the precipitation takes place in a period of time sufficiently long to allow the water to escape by means of the canal without any necessity of appealing to the pumps; and when these pumps do have to work, the probability is that in a period of ten years they will never have to be put in operation for a longer time than three hours. But let us suppose that every one of these rains should fall in a period of time that would demand the help of the entire pumping plant for three hours on each occasion: it would only amount to *fifty-four hours in the whole year*, under which circumstances the expense of coal would be very insignificant;—which shows that the engines must be very simple and economical in first cost, as it would not pay to go to any heavy expense in the purchase and setting up of expensive machinery.

We have already said that to flush these sewers it will be indispensable to introduce into the city the necessary waters from the lakes of Chalco and Xochimilco, and that to obtain the desired result with these waters it will be necessary to carry them to the highest point in the whole system of sewers.

A careful study of the conditions under which we can procure a supply of these waters, of the differences of level, and of the condition of the canals by which they would travel, has brought me to the conclusion that it would be necessary to raise this water, at the point where it will have to be introduced into the city, to a height of sixteen feet, more or less; and as the amount of water which will have to be elevated will be forty-one thousand gallons per minute, and the pumps performing this work will have to be in operation every day the greater part of the year, it is well worth while to spend money on them in order to procure economy of fuel, and that the engines should be of the compound type and provided with surface condensers.

This is, in general, the application that I have given to the principles of sanitary science with the object of improving the hygienic conditions of the capital of the Mexican Republic, and as my studies contain nothing new, I have the honor to present it to this society simply as a work of the present day; and I take great pleasure in this opportunity that presents itself to publicly tender my thanks to Messrs. Rodolfo Hering, Elliot C. Clarke, and Benezette Williams, who received me with the greatest kindness, and supplied me with the most valuable data on the drainage of great cities, when, in the year 1886, I had occasion to travel through this country studying the important subject of which we are treating. The works of these gentlemen, and their extensive knowledge in these matters, are sufficiently well known, and all I could say in their favor would be little for their merits, nor would it add another leaf to their laurels.

XI.

REPORT OF THE COMMITTEE ON CAR SANITATION.

By Prof. W. W. Daniells, Chairman.

Your Committee upon Car Sanitation would report that the want of proper sanitary conditions in connection with railroads has long been recognized. Railway authorities have felt the necessity of keeping their stations and adjacent premises clean, and for many years have furnished disinfectants, with codes of rules for their use, which have resulted in an improvement of the stations' surroundings, although they have not always secured ideal sanitary conditions.

The sanitary requirements of railway-cars have rapidly increased within a score of years. When routes over which a train was run were short, and frequent changes of cars were required in making a long journey, the keeping of cars clean and wholesome was much easier than it is to-day. Now the most important trains are travelling hotels, in which the passengers are to live from one to four days. The sanitary conditions necessary to health and comfort are the same here as in any other place of residence, while the difficulty of securing these desirable conditions increases with the length of time the car is in service. Hence the greater convenience of our admirable system of through trains is accompanied by the greater difficulty, as well as the more urgent necessity, of keeping the cars in a wholesome condition.

The recognition of these facts has led to the production of two excellent papers upon the sanitary condition of railway-cars by members of this Association.

One of these papers, by Dr. R. Harvey Reed, of Mansfield, Ohio, of this committee, was read before the Ninth International Medical Congress. In it Dr. Reed gives the results of an elaborate series of investigations made by himself, as to the effectiveness of the present means of heating and ventilating railway-cars, as well as upon their cleanly condition. So far as the writer of this report is aware, this is the only series of experimental observations upon this subject which has been put upon public record. The second paper, by Dr. Granville P. Conn, was read last spring before the National Association of Railway Surgeons. This paper, while more general in its treatment of the subject, is full of wise suggestions. To the authors of both these papers your committee would acknowledge its indebtedness.

The proper sanitary requirements of railway-cars are,—(1) perfect cleanliness; (2) fresh air at all times, free from dust, smoke, and cinders; (3)

during that portion of the year when artificial heat is required, heating apparatus that will, while the cars are suitably ventilated, maintain an equable temperature of 65° to 70° F. in all conditions of weather to which the car may be subjected.

Cleanliness.—Responsibility for the perfect cleanliness of cars starting on a journey rests upon the railway authorities. At all stations at which trains are made up, it should be the duty of some intelligent employé to see that each car when put in service is clean, and that it has been thoroughly aired since last in use. Especially, should he see that the closets have been thoroughly cleansed and aired, and that they are free from all offensive odor.

When the railway authorities have fulfilled these conditions, responsibility for keeping the car clean during its journey becomes a divided one, and perhaps devolves quite as largely upon the occupants of the cars as upon those in charge of the train. The frequent uncleanly condition of first-class passenger-coaches that have been but a few hours in service is familiar to all. And this condition is largely due to the want of that cleanly care on the part of passengers which they are accustomed to exercise in their homes. Very good people, when travelling, forget their duties to fellow-passengers, and are guilty of offences, which, to say the least, should meet with some rebuke. Throwing upon the floor fragments of lunches, the refuse of fruit, etc., or depositing there sputum or the expectoration of the tobacco-chewer, is as great an offence in a railway-car as in a first-class hotel. Yet in the latter case no one would think of committing these offences, nor would he be permitted to do so were he so inclined.

The continued cleanliness of a car in service requires, then, that its occupants should exercise the same cleanly habits while travelling that they exercise in their homes, and that they should, so far as is possible, refrain from doing anything which tends to make the car offensive in appearance, or unwholesome as a place of abode.

At the same time the railway authorities should exercise that watchfulness in keeping the car clean, and the same authority to demand in this regard due diligence on the part of the passengers, that the keeper of a first-class hotel is bound to use toward his guests. When these mutual obligations between the passengers and the railways are lived up to, the cleanly conditions of passenger-coaches will be greatly improved.

The railway authorities especially should see to the frequent cleansing of the closets and urinals. In this respect they are often sadly derelict in duty. There is no sufficient excuse for the offensive odor frequently arising from these compartments, and the travelling public should accept none. It should be the duty of some employé of the road to cleanse the urinals with sufficient frequency to prevent any unwholesomeness from this source. And it ought to be imperatively demanded that each conductor shall see that this service is effectually performed while the train is under his control.

In the opinion of your committee, this may be done without adding to the present expense of running trains, and it is the right and the duty of those who travel to demand that it shall be done. The means of accomplishing this end may best be left to those in authority.

Heating and Ventilation.—The ventilation of railway-cars during the summer-time would be an easy matter were it not for the constant presence of dust, smoke, and cinders in the atmosphere surrounding a moving train. These impurities must be removed, if at all, by mechanical means. If mechanical means of ventilation are used, they should be such as may be successfully used in connection with the heating apparatus during the colder portion of the year. On this account, one might reasonably expect to find the heating and ventilating appliances of a railway-train to bear some definite relation to each other. So far as your committee is aware, no such system is in use. The means in general use for ventilating cars are thus described by an official of one of the large roads entering Chicago. "Each coach has thirty-eight Hartman patent sashes in clearance deck, eighteen on each side about 7x24 inches, and one at each end of car 8 x 48 inches. These sashes can be pulled down a few inches or opened wide, and are covered on the outside by wire cloths, preventing cinders from entering through the same." He adds, "This system gives good satisfaction, and our coaches are as well ventilated as any first-class coaches." The last statement is doubtless true, for as all use the same system there must be a high degree of uniformity in the results obtained. That this method of ventilating, while giving the railway authorities "good satisfaction," does not, at least during that portion of the year when artificial heating is necessary, supply to passengers that wholesome atmosphere with which alone they ought to feel satisfied, is proven by the experimental results obtained by Dr. Reed in the paper before referred to. It may be well to state here that these experiments were made upon three of the great roads running through Ohio, so that they may fairly be taken as representing the conditions to be found upon the best roads of the country. The observations were made in the daytime during the months of December and March, that is, when doors and windows were kept closed and artificial heat was required.

Dr. Reed had an analysis made of fifteen samples of air from first-class passenger-coaches, and of eight samples from sleepers. The carbon dioxide in the air of coaches varied from 4.41 parts in 10,000 of air with eleven passengers, to 18.33 parts when fifty-seven passengers were present. In the air examined from sleepers, the carbon dioxide was found to vary from 4.26 parts in 10,000 of air with twelve passengers, to 13.35 parts with the same number present. The mean of the results of the eight analyses of the air of sleepers was 9.76 parts carbon dioxide in 10,000 of air, and in only one case was there found to be present less than 8.5 parts.

In both passenger-cars and in sleepers, as is shown by the mean of all the analyses made, the air contained more than twice as much carbon

dioxide as is found in the atmosphere, and the sleepers contained, on an average, one seventh more carbon dioxide than the coaches. This result may doubtless be attributed to the fact that there is less opening of doors in sleepers than in coaches. The change of air produced by opening the doors of a car is well shown by one of Dr. Reed's experiments. In a coach containing twenty-three passengers, the doors were kept closed for thirty-five minutes, when there was found present 10.78 parts carbon dioxide in 10,000 of air. The doors were then opened for two minutes, when, with twenty-one passengers present, the carbon dioxide was reduced to 4.22 parts in 10,000, indicating that the air of the car had been almost completely changed during the two minutes of open doors. The outside temperature at the time of making this observation is not given, but in connection with other observations made the same day, the temperature is given as 27° F. The rapidity with which the air would be changed would of course depend to a great extent upon the difference in temperature without and within the car.

The heating of cars is now mainly done by means of steam, or by water which is heated by steam. There are a number of devices in use by both methods, which, so far as heating alone is concerned, are fairly efficient. The great fault with them all is, that they are planned to heat entirely regardless of ventilation. Or perhaps it would be more nearly correct to say that the method of ventilation in use is planned in violation of those physical laws by the aid of which only can good results in heating be obtained. A dwelling cannot be heated and ventilated, unless there is an intimate relation between the methods by which these two results are to be accomplished. No wise man would attempt to warm his house from sources of heat distributed near the floor, and at the same time depend upon openings at the top of the rooms for ventilation. He would expect, with such conditions, neither properly warmed nor properly ventilated apartments. Why should better results be expected on our railway-trains, where the obstacles to be overcome are much greater?

The vitiated atmosphere found in cars, in the experiments above quoted, prove the means of ventilation in use inadequate to supply a wholesome atmosphere during the day-time, when there is much more opening of doors, than during the night. It is greatly to be regretted that we have not a similiar series of experiments upon the ventilation of sleepers at night, when, according to common experience, the atmosphere of the car is much less pure than during the day.

Let us see if the results obtained from the heating appliances in use are more satisfactory.

The proper heating of a car requires that it shall be kept at a moderate temperature, and that the heat shall be equally distributed throughout the car. Dr. Reed found the difference in temperature at the level of the head while sitting, and the bottom of the car to be in one instance as much as 30° F. This was in a sleeping-car, with the outside temperature at 12° F.

The mean of six observations of the difference of temperature at the floor and at the level of the head in a first-class passenger-coach was 17.1° F., while ten observations of the same kind in sleeping-cars gave an average difference of 20.3° F.

We pay an extra price for the privilege of occupying sleepers during the day, and get, if the results of the above experiments are a true indication of the usual conditions that obtain, a less wholesome atmosphere and a less equably heated apartment than are found in the ordinary coach.

The cars upon which these experiments were made were ventilated by the method described above by a railway official as giving "good satisfaction." The heating was done by Baker's system of hot water heated by steam. But the unsatisfactory results obtained do not necessarily indicate that the method of heating was at fault. It is impossible to have a well ventilated, and at the same time an equably warmed, apartment with the entrance and exit of air at the top. The lesson to be learned is, that the means used are inadequate to obtain the desired end. Besides all the difficulties inherent to the heating of dwellings, the railway-car has some peculiar to itself. Among these are,—1st, the thin walls, which to a large extent are composed of glass; 2d, the large amount of radiating surface compared with the cubic contents of the car; 3d, the car is most of the time in rapid motion, which produces the same effect, so far as heating and ventilating are concerned, as a strong wind upon a stationary structure; 4th, the absence of a tall heated shaft or chimney, to aid in moving the air. It seems but reasonable to suppose these obstacles can only be successfully overcome by the use of mechanical appliances by which to force the air into the car.

Dr. Reed suggests taking air from the front of the locomotive, where it is free from dust, smoke, and cinders, and carrying it by means of pipe conduits back to the cars, to which it is distributed as desired. He would use a pump driven by the locomotive to move the air. By this means air can be passed over heating apparatus, and thus warm the car as well as ventilate it when artificial warmth is required. But the air-pump would be required at all times to secure the needed ventilation. An apparatus has recently been devised for ventilating cars by pressure- and exhaust-fans run by a friction-pulley from the car axle. The air is forced through water, before entering the car, to free it from dust and cinders, and may be distributed in the car as desired by a system of pipes controlled by valves. As many members of this Association can testify, a short trial of this apparatus at Charleston last December promised most excellent results. Dr. H. B. Horlbeck, a member of this committee, recently writes in regard to a car ventilated by this system: "I have personally travelled on the 'Evelyn,' and found the car continually supplied with fresh and pure air. This was most noticeable, and the difference as to the outside surroundings was very marked. While everything outside was covered with dust and dirt, the interior of the car was perfectly clean, and free from dust and cinders." Doubtless all who witnessed the trial of this invention at

Charleston will agree that Dr. Horlbeck's statements are in accord with their experience.

Should there be no mechanical difficulty in the working of this device, it would seem to be the nearest to a solution of the problem of car ventilation of any invention of which your committee is aware. And when applied in combination with an arrangement for heating the air before it enters the car, it will be an efficient means of both heating and ventilating. Railway mechanics, whose opinions should carry great weight, have told the writer that there are insuperable difficulties in running machinery from the car axle, and hence that any device depending upon this method of propulsion must prove a failure, while those interested claim the invention to be a great practical success. Experience must decide between these conflicting opinions. The public may well desire the success of the invention.

There is another obstacle to the suitable heating and ventilating of cars, which must be obviated before satisfactory results will be obtained. I refer to movable windows.

No one would expect to warm a house satisfactorily, if it were surrounded by a row of windows each of which might be opened wide at the whim of the person sitting next it. To get good results from the best of systems would be impossible under such conditions. And when no heat is needed, the open-window fiend plies his calling, only to fill one's eyes, throat, and lungs with smoke and dirt. There is no sufficient reason for having car windows movable, or, at least, there will be none when cars are ventilated by mechanical means, as they soon will be, we trust.

A few years since, two of the prominent roads entering Chicago furnished their cars with windows which could not be opened. It is said the patrons of these roads were so incensed at this change that so far as possible they used other roads. To prevent losing a large share of their patronage, the managers were forced to restore the movable windows. The travelling public are very jealous of what they deem their rights, and are quick to resent any attempt to curtail them; but in the case in question they rebelled at a change made for their own benefit.

The responsibility for the present unsatisfactory methods of heating and ventilating cars is by no means to be borne by railway managers alone. The public must consent to bear its legitimate share. Railway corporations are purveyors to the people, and within reasonable limits will supply the demands of their customers. The writer was recently shown at Pullman a train of cars intended for service between New York and Washington, which was said to be the finest train that had ever left the Pullman shops. His attention was especially called by his guide to the beautiful design of the fretwork, to the expensive stuff used in upholstering, and to the fineness of the finish of the wood-work. The cars were certainly most luxuriously elegant. But the ventilating was still to be done from the top of the car, and the heating appliances were independent of the introduction of fresh air. These cars were built by an intelli-

gent and enterprising company. They understand that it is for their interest to build such cars as the public desire. Greater sums are expended upon the elegant finish of the cars than upon their sanitary equipment, because that is what best pleases their patrons. When those who travel are as willing to pay for more wholesome surroundings as they now are for cushioned elegance, more wholesome surroundings will be furnished them.

The people need instruction, that they may know what to demand. When they have learned their needs and how to formulate them, some one will be found to supply the desired conditions. Reforms of the nature of the one under discussion rarely come quickly. Discussion and agitation must precede the change. The American Public Health Association is the best possible body to inaugurate such a movement.

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Dr. R. Harvey Reed,
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XII.

WATER-SUPPLY AND PUBLIC HEALTH.

By ALLEN HAZEN,

Lawrence, Mass.

During the last few years, there has been accumulating an overwhelming amount of evidence that typhoid fever is often transmitted from one person to another by drinking-water. I need not refer to the experience of foreign cities, but only to mention epidemics, during the past year alone, at Albany, Wheeling, Duluth, Lowell, and Lawrence, besides many others of less extent. In a part of these cases, at least, most thorough investigations have been made, showing beyond question that the excessive death-rates were due to the pollution of the public water-supplies.

Investigations have also been made, both in England and in India, showing that Asiatic cholera is most frequently conveyed by drinking-water, and we have to consider what part our water-supplies might take in its propagation in the unfortunate event of its gaining a foot-hold on our shores.

It behooves us, then, to give this subject most careful consideration, with a view to understanding the exact method of transmission, and, if possible, to find measures which will secure relief.

Both typhoid fever and cholera are caused by the growth within the body of particular species of bacteria, which are most frequently taken into the system through the mouth, either with the food or drink, and it is the presence of these particular germs in a water which gives it its power of causing disease. A water may be muddy, or hard, or discolored by organic matter, it may even be sewage-polluted and swarming with germs, but if it does not contain the objectionable species, its use will not cause the diseases in question.

At first sight it would appear that bacterial examination for the hurtful forms should give the true criterion of the character of a water. The difficulty of the search for pathogenic organisms, however, has greatly limited this line of work, and only confirmatory results have thus far been obtained; the bacteria have not been found until after their presence has been indirectly proved by an excessive number of cases of typhoid fever among the users of the water, which could not be ascribed to any other cause. Improved methods are being suggested for the detection of the typhoid bacillus, and it is quite probable that in the future we shall have methods at our disposal, far more satisfactory than those which we have been using.

But when we have a greatly improved method for the detection of the bacillus, how much will it help us? That the fever is due to water-supply has been amply proved in numerous cases, by eliminating other possible causes, and by showing that those who drank from one water-supply suffered, while their neighbors, with other water, remained free. Now when it is once established that a water-supply causes typhoid fever, the number of cases among the consumers of the water is a far more satisfactory index of its condition than any laboratory tests, however perfect. In the case of proposed water-supplies not yet introduced, the death-rate test cannot be applied, and we must have recourse to other methods. But supposing it were possible to show absolutely that disease germs were absent from a given river, no proof has been given that they will be absent a month hence, under somewhat changed conditions of temperature, volume of water, etc. The Merrimack river water often produces typhoid fever among those who drink it, but not always: there are times when its influence is scarcely perceptible; at other times it is capable of causing an epidemic. Aside from any analytical imperfections, the bacterial methods cannot guarantee the future of a water from its present condition, and as it is the future in which we are mainly interested, we must look for other sources of information.

So far as we know, the germs of communicable disease are absent from unpolluted waters; they are introduced only by sewage. Waters which are absolutely free from the product of human life are, in general, safe for drinking. It is our first problem, then, to determine whether a water is sewage-polluted. This is done by inspection of the water-shed, or by chemical analysis, or by both. With surface waters, inspection of the water-shed is usually of the first importance. The sight of Lowell's sewers is better proof of the contamination of Lawrence's water-supply than any amount of chemical or bacterial analysis. In this case, analysis is useful in measuring the amount of pollution, and in showing any purification which may have taken place. In the case of ground waters, inspection of the water-shed is often impossible, because its exact location is unknown. In these cases, thanks to the great progress which has been made in the methods of examination, we may depend with confidence upon chemical analysis to show us the past history of a water. The analysis is especially satisfactory when the normal chlorine is accurately known. The normal nitrate is also useful in this connection. In Massachusetts, strictly unpolluted ground waters rarely have as much as 0.02 part nitrogen or nitrate per hundred thousand, and as this does not depend upon proximity to the ocean, it can be used where the normal chlorine is unknown.

If we can show that a water is absolutely free from sewage, we may safely infer the absence of pathogenic germs, although, as yet, too little is known of the diarrhœa and other complaints which have been sometimes attributed to water quite free from sewage. The adaptability to public use of a sewage-free water depends mainly upon its physical characteristics,—turbidity, color, odor, taste, and hardness. On these points, the

public is a competent judge of what is required; the chemist makes accurate comparisons between different waters, but it is for the consumers to say what is satisfactory to them.

If we find that a water-shed is inhabited, or if the chlorine and nitrates are above the normal, then we must conclude that the water is polluted, and other data must be obtained before we can decide upon its quality. The possibility of securing water entirely free from sewage contamination is rapidly becoming less. With increasing population, water-sheds of sufficient size are fast becoming settled, and in those portions of the country where the entire surface of the land is suited to human occupation, and especially in the neighborhood of large cities, their retention for water-supply is practically impossible.

We are thus forced to face the problem of so managing an inhabited water-shed, and the water derived from it, as to secure a water-supply which, although it has been polluted, is without danger to the public health.

The question now to be considered is, whether pathogenic germs could survive from the point of contamination to the point of consumption. It is not enough to show that they are not now present in the water; it must also be shown that they could not be present under any possible, or at least probable, conditions. It is our greatest problem, to determine through what conditions pathogenic germs can survive.

In its simplest form, we have the case of sewers emptying directly into a water-course which is used for water-supply. There has been a theory current that rivers have a power of purifying themselves, and that when the volume of sewage is not too large, in comparison with that of the water into which it flows, the great dilution and the oxidizing action of the air will soon restore the river to its original purity. Lawrence, Lowell, Albany, and other cities, knowing that their water-supplies were polluted, have depended upon these agencies to purify them, and they have depended in vain. Their factors of safety were too small,—the Merrimack and the Hudson were not large enough; the distances and times were too short; the germs survived,—and increased death-rates, amounting to epidemics, were the results. The experience thus dearly obtained, with the loss of hundreds of human lives, has taught us lessons far more valuable than any laboratory experiments, however interesting the latter may be. We have learned that extreme dilution, even so great that the most delicate chemical tests do not with certainty show the presence of sewage; that running for a few miles in a large and well aerated river; that storage in a reservoir capable of holding one or two weeks' supply of water; and that the passage through miles of iron pipes under pressure,—that each and all of these conditions are inadequate to render a water safe.

Prof. Sedgwick has shown, in his admirable report upon the sanitary condition of Lowell, that after the Merrimack water had passed through the capacious reservoir and several miles of iron pipes, requiring in all at least several days' time, the total number of bacteria was greatly reduced, and apparently, also, the number of typhoid germs, for there were relatively

less cases among the users of this water than among those who drank the canal water taken more directly from the river.

It is possible that these conditions might be so extended as to secure immunity, or at least so to decrease the number of disease germs that their presence would be without noticeable effect upon the public health. In view of our experience, we shall do well to inquire what limits, if any, are admissible, and, in the meantime, take good care to avoid all water-supplies taken without filtration from bodies of water into which sewage directly flows. Until we have positive information that the objectionable germs cannot live beyond certain limits, we can only be justified in refusing to allow any limits, and in condemning all waters so polluted.

As a solution to our problem, we may have recourse to some method of purification, either of the sewage before turning it into the water, or of the water after it has been polluted; The only processes now known, which are at once feasible and effective in the removal of bacteria, are processes of filtration. Filtration may take place either through natural soil, or through specially prepared filters. In either case it may, or it may not, be an efficient safeguard against sewage contamination. Many household filters are notoriously inadequate; many old wells are unmistakable carriers of disease drawn through the soil from neighboring cesspools; while, on the other hand, people drink with impunity the water from other wells, even more grossly polluted, but in soils which are more favorable to the removal of bacteria; and in some European cities a great reduction of the death-rate from typhoid fever is effected by the introduction, not of a sewage-free water, but of a well filtered, although previously polluted, water.

The sewage of the inhabitants of a drainage area may be filtered, either from cesspools connected with each house, in which case their contents slowly soak or filter through the soil toward the water-courses, or the sewage may be collected and treated by intermittent filtration. In either case, great care must be taken that no trace of sewage finds a more direct channel than was intended.

Intermittent filtration is only able to exclude bacteria from the effluent under particular conditions; and these conditions must be fulfilled to insure safety. The experiments of the Massachusetts State Board of Health, conducted under the direction of Mr. Hiram F. Mills, have shown what many of these conditions are. I have no time, at present, to discuss these experiments; I can only refer to the published report, and say that so much light has been obtained as to make possible reliable estimates of the results to be obtained under a wide range of local conditions.

Another way of approaching the problem is, to allow the free entry of sewage into the water-courses, depending upon filtration to remove the bacteria from the water before it is delivered to consumers. In the case of large inhabited water-sheds, as, for instance, that of one of our large rivers, this is the only practicable way, it being impossible to maintain adequate inspection of a large area and population.

When extensive sand deposits occur along the banks of the river or lake, wells of filter galleries sunk in them have often yielded a large amount of water, so well filtered by its passage through the sand as to be quite safe. Under other local conditions, similar wells have failed to yield the quantity or quality of water desired. This method of filtration is most important, but as yet no general conclusions can be safely drawn.

When there are no sand deposits to make wells and filter galleries successful, other forms of filtration have often been used.

Very prominent are the patented mechanical filters, whose essential characteristics are very high rates for filtration through small bodies of sand, often with the use of chemicals and under pressure. Such filters have been most successful in removing suspended matters from turbid river-waters, rendering them suitable for paper and other manufacturing, and also to improve the appearance of muddy, but unpolluted, waters. The success of these filters in their proper sphere is great and unquestioned. We have, as yet, however, no proof that they are capable of removing completely the bacteria from sewage-polluted waters. Until we have positive evidence that a system of filtration, under all conditions likely to occur in practice, will exclude pathogenic germs, we shall not be justified in approving its use for sewage-polluted water. The cleaning of unpolluted water is entirely another matter, not to be confounded for an instant with the present problem.

In many European cities, another and widely different system of filtration is in use. The water to be filtered is taken on to large areas of thoroughly underdrained sand, kept continually covered with water, which slowly finds its way through the sand at a rate of one, two, or even three million gallons per acre daily. The results obtained at Berlin are especially valuable, for the engineer in charge has taken into account the removal of pathogenic germs, both as shown by laboratory experiments, and by the death-rate from typhoid fever among the users of the water.

Piefke's results show that, under conditions sure to occur without most careful superintendence, bacteria pass the Berlin filters in sufficient numbers to increase the death-rate; but by giving most careful attention to details, this can be almost entirely avoided. If the filters do not remove every single germ, the number which escape is too small perceptibly to affect the death-rate. These results, and those of other European cities, show us that continuous filtration may, or may not, be an efficient safeguard against typhoid epidemics, according to the rate of filtration, the character of the sand employed, and other details of management.

The point is established that filters can be so constructed and managed as to afford relief. We must now endeavor to find how to attain the desired result with the minimum expense; how coarse materials can be used with safety; how rapidly water can be applied to material of various degrees of fineness? Can the best results be obtained by applying the water continuously, or at intervals, with periods of rest between, during which the filter has a chance to drain, drawing air into its pores?

These, and similar questions, require definite answers. Experiments now in progress at the Lawrence Experiment Station were designed to throw additional light upon these points. We know that fine materials and slow rates of filtration tend to give germ-free, and consequently safe, effluents.

Some limits are already known, both from the experience of European cities and from our own experiments. Some filtering materials, at certain rates of speed, give effluents practically free from bacteria. It is possible that we shall learn by further experiment that somewhat coarser materials, or that higher rates of filtration, may be employed without danger. In the meantime, when it seems necessary to take water-supplies from bodies of water into which sewage directly flows, we can best secure the public health by the use of filters which are definitely within the known limits of safety.

XIII.

LAND LIBERATION AS A PUBLIC HEALTH MEASURE.

By GEORGE HOMAN, M. D.,

St. Louis, Mo.

At the last meeting of this Association I had the honor to present to your indulgent attention a paper on the relation, as I conceived it, that land monopoly, or the existing system of private ownership of land, bears to public health, especially as the question presents itself in connection with city populations. I sought therein to show that such a system was inimical to the best sanitary and vital interests of the people, inasmuch as its inevitable tendency was to produce an overcrowded condition of the human inhabitants, housed in tenements or hovels as the case may be, and which congestion fostered the development and favored the spread of all those diseases which modern hygiene finds it most difficult to cope with and subdue.

In that paper I contented myself with pointing out this fact, and assigning the cause, as I understood it; and if such is the natural necessary result of the present system of land-holding, then it is a further duty incumbent on those who hold such views to proceed further, and indicate what in their opinion is the cure for such serious defects in the social and sanitary economy of our times; for surely civilization cannot normally advance, when in the heart of our greatest cities there arise to constant view spectacles of want, misery, disease, and crime that cannot be matched in savage lands.

If such a wrong exists, in the nature of things there must be a remedy; and many thoughtful people have come to the conclusion that this remedy will be found in such an alteration of our laws as shall fundamentally change the conditions under which land is now treated and held.

If the proportions of the evil indicated are, as many contend, of such magnitude as to threaten already the foundations of social order and test to the utmost the genuineness of our civilization, then no prophet's warning should be needed, in this country at least, before the remedy is found and applied which shall harmlessly dissipate the explosive forces now generating, and establish justice and tranquillity between man and man where now wrong and discontent prevail.

In my individual experience concerning this matter, the true cause of the spectacles of sickness and suffering, misery, destitution, squalor, sin, and crime, abounding among a city's population, as for a number of years they were presented almost daily to my view in public hospitals, dispensaries, poor-houses, tenements, and slums, was an insoluble problem which

constantly perplexed me until I happened on some of the writings of Henry George which treated of the land question, when all difficulties vanished, and I stood amazed that an explanation, at once so simple, sufficient, and true, had not occurred to me before. For it was at once very plain that as land is a provision of nature for the use of man, and that he cannot live without it and must live on and from it, the person who can get a monopoly possession of land enjoys an unfair and very great advantage over his fellows, equally deserving naturally, as they must buy from him the right to use the earth on such terms and conditions as may please him, and to which their necessities compel acquiescence.

The sanitary mischief flowing from the exercise of this power may be most grave, and this is largely determined by the financial ability of the applicants or occupiers to pay rent, or to buy their right to live; and it is my belief that this system is responsible, directly and indirectly, for more of the evil conditions present among city populations than arise from any other cause, or perhaps all other causes.

The remedy proposed for this evident inequality and wrong in our present method of dealing with land is, briefly, the application of the single tax, the elements of which no doubt are familiar to those now present, and concerning which it is a matter of regret that the name so inadequately expresses all that is embraced by it,—the nature of the proposed reform, its far-reaching scope, utility, etc.; for in my opinion no social movement of the past hundred years is, or has been, so big with possibilities for good to the human race as this one.

Apart from its purely fiscal aspect as an ideal method of raising public revenues, it has moral, social, and economic sides equally interesting; and these being intimately related to affairs of daily life and living, questions of individual and public health naturally come up for consideration in this connection.

If the rise and progress of civilization be in accordance with the laws of human development, the observed tendency of such development being to aggregate man into communities large or small, and as his enlightened reasonable wants under such conditions are vastly greater and more complex than when in a less advanced social state, then there should be some natural provision of a fund out of which all such public wants could be satisfied.

Single tax men hold that nature in this respect has made no default, that such a fund does exist, that it grows with the growth of population and is in strict relation to population, that every increase whether of infant or adult adds definitely to that fund, and that this law is as universal and unfailing in operation as that which brings the milk to the mother's breast for the nourishment of the new-born child.

As things now are, the men who own the ground are the ones who reap the benefit of this result of social growth and progress,—the rental value of bare land. They have not made it, but they appropriate it in the form of ground rent; hence, those who are not of the landlord class must buy of

them their right to use a bounty of nature without which life is not possible; for our laws are framed in their interest through a misconception, an economic error in confounding land with property, for no man made land any more than air and sunlight, which are natural provisions for his use, and it is not in his power to add to or diminish their amount in the least.

The supply of available or desirable land is limited, and this leads to its being monopolized by those who speculate in it on the necessities of other people, or hold it out of use until the growth of population has made it valuable, this increment representing the value given to the site by the community as a whole, the landlord thus reaping where he has not sown, out of the necessities, enterprises, and industries of all the people in the place.

The complete application of the single tax presupposes the total abolition of every other means of public revenue, national, state, and local. It of course involves the extinction of all custom-house duties, tariff levies, taxes on trade and industry of every kind, and the centering on land values as the sole source of governmental support.

Economists who hold these views claim that property in the right meaning of the word embraces everything, and only those things, produced by human labor, and that to tax such products is to discourage production, embarrass enterprise, and levy a fine on industry; and, moreover, that the moral effect of attempts to do this is bad, leading to discontent, concealment, false returns, and perjury,—the weight of taxation falling on the poor, or on those whose property is in plain sight of the tax-gatherer and who are least able to bear it, while the rich are, to a great extent, able to evade their just share of taxation.

If this form of taxation were abolished, the people who constitute the bulk of our population, the wage-earners, would experience immediate relief in their struggle for existence, the material effect of the change being described as follows:

"In the first place, all taxes that now fall upon the exertion of labor or capital would be abolished. No one would be taxed for building a house or improving a farm or opening a mine, for bringing in things from foreign countries, or for adding in any way to the stock of things that satisfy human wants and constitute national wealth. Every one would be free to make and save wealth; to buy, sell, give, or exchange, without let or hindrance, any article of human production the use of which did not involve any public injury. All those taxes which increase prices as things pass from hand to hand, falling finally upon the consumer, would disappear. Buildings or other fixed. improvements would be as secure as now, and could be bought and sold, as now, subject to the tax or ground rent due to the community for the ground on which they stood. Houses and the ground they stand on, or other improvements and the land they are made on, would also be rented as now. But the amount the tenant would have to pay would be less than now, since the taxes now levied on buildings or improvements fall ultimately (save in decaying communities) on the user, and the tenant would therefore get the benefit of their abolition. And in this reduced rent the tenant would pay all those taxes that he now has to pay in addition to his rent,—any remainder of what he paid on account of the ground going not to increase the wealth of the landlord, but to add to a fund in which the tenant himself would be an equal sharer.

In the second place, a large and constantly increasing fund would be provided for

common uses, without any tax on the earnings of labor or on the returns of capital—a fund which in well settled countries would not only suffice for all of what are now considered necessary expenses of government, but would leave a large surplus to be devoted to purposes of general benefit.

In the third place, and most important of all, the monopoly of land would be abolished, and land would be thrown open and kept open to the use of labor, since it would be unprofitable for any one to hold land without putting it to its full use, and both the temptation and the power to speculate in natural opportunities would be gone. The speculative value of land would be destroyed as soon as it was known that, no matter whether land was used or not, the tax would increase as fast as the value increased; and no one would want to hold land that he did not use. With the disappearance of the capitalized or selling value of the land, the premium which must now be paid as purchase-money by those who wish to use land would disappear, differences in the value of land being measured by what would have to be paid for it to the community, nominally in taxes but really in rent. So long as any unused land remained, those who wished to use it could obtain it, not only without the payment of any purchase price, but without the payment of any tax or rent. Nothing would be required for the use of land till less advantageous land came into use, and possession thus gave an advantage over and above the return to the labor and capital expended upon it, and no matter how much the growth of population and the progress of society increased the value of land, this increase would go to the whole community, swelling that general fund in which the poorest would be an equal sharer with the richest."—Protection or Free Trade, Chap. xxvi.

Now with this prosperous change effected through the operation of equal laws, and by securing to all the right to make use of natural opportunities as they may desire in the production of wealth, it requires no vivid imagination to perceive the gain to public health that would follow. A most noticeable effect would appear in the ability of every family to have a house of their own, each according to the means possessed; and it can hardly be disputed that the hygienic dispersal of the populations now congested and compacted in tenements and slum districts furnishes the key to the whole problem of city sanitation, as it relates to the control and suppression of communicable diseases. By this general movement chronic fever-nests and hot-beds of disease coming down from former generations would be abandoned, and even if the seeds of disease were carried with them by the departing occupants and developed in their new homes, effectual isolation could be enforced, and the general sanitary management to prevent its spread simplified and made more perfect, as is shown now in dealing with such contingencies in families occupying separate domiciles.

Of course, a change so profoundly affecting present customs and modes of thought could, probably, only gradually be brought about, although in this country the effective introduction of the single tax waits only on legislative enactment, or, perhaps, on constitutional amendment, and the effect on public health would appear at first but slowly; for the accumulated weight of generations of morbidity and physical wrong-doing would not vanish from the race in a day, but the start in the right direction being made and continued, a degree of general physical health and excellence would be attained such as tradition and history ascribe to man in earlier ages.

It is not argued that the introduction of the proposed remedy would

operate as a cure-all for every social defect or disorder; and while it is urged in this connection solely as a potent, practical public health factor, at the same time its application would render the accomplishment of other needed reforms vastly more easy, as those who have looked into it have been led to believe. And while desiring here to emphasize only the sanitary aspect of the matter, and leave its other features to those who may choose to lay stress upon them, I feel that I cannot do better in closing than to give the words of Mr. George himself, as follows:

"For what is the core, the essence of our belief—we who, for want of a better word, call ourselves single-tax men? It is that there is in social relations as in physical relations a law, an order—a law which everywhere coincides with the moral law; an order which shows intelligence and beneficence. The simple yet far-reaching reform that we urge is to us no ingenious scheme devised by human wit, no deftly invented panacea to cure human ills. It is something far simpler, yet transcendently grander: it is the conformation of human law to the supreme law of justice. . . . The injustice, the want, the suffering, growing out of bitter poverty on the one side and monstrous wealth on the other, that so threaten and perplex the world to-day, raise no doubt in our minds of the existence and beneficence of a supreme intelligence. . . . We see, in the material provision made for men, room for all, work for all, abundance for all, and opportunities of leisure and the fullest development for all, conditioned only on men's obedience to the moral law that teaches us to give each his right; to do to others as we would have others do to us. We see that in the most highly developed civilization there is no difficulty in securing to all an equal share in their Creator's bounty, but that in the divine forethought a provision has been made by virtue of which the very growth of society, by increasing land values, provides a fund adequate for all the increasing needs of society, and that to apply this to its intended purpose would be to make the growth of civilization an advance toward greater and greater equality. And thus we see that the evils which afflict the world, and which to so many shut out the idea of the moral government of the universe, spring really from the wrong that disinherits the masses of all share in their birthright, and turns into the reward of greed and the incentive to forestalling the provision designed to supply the wants of society and promote equality."—The Standard, No. 242.

XIV.

ON THE PROPAGATION OF DISEASES AMONG CHINCH-BUGS.

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The experiments of the past summer prove that the white fungus (*Sporotrichum globuliferum*) and the gray fungus (*Empusa Aphidis*) are capable of producing fatal and rapidly spreading disease among chinch-bugs.

On May 23 we began our experiments with sporotrichum. We distributed some fungus-covered bugs from the field of Mr. M. F. Mattocks, of Chautauqua county, Kansas, in six infection jars. Into the jars had been put soil, taken from the yard, and green wheat. Fresh chinch-bugs, sent by the farmers, were put into the jars,—enough to thickly cover the bottoms. The jars were covered with cheese cloth, and set into a glass case containing moist sand. The soil in the infection jars was not watered; so that the bugs were in a humid atmosphere, but not in contact with water. We were in this way able to secure the best conditions for the development of the fungus. When the bugs in the jars died, new bugs from the field were put in, the date of restocking being also a record of the time when the bugs in the jar had nearly all died. The following is the memorandum for the six jars started May 23:

May 23,	June 4,	June 20.		
May 23,	May 27,	June 4,	June 15.	
May 23,	June 4,	June 15.		
May 23,	May 27,	June 4,	June 15–20.	
May 23,	May 27,	June 4,	June 15,	June 20.

Seven jars were started May 25. Their record is as follows:

May 25,	June 4,	June 19.	
May 25,	June 4,	June 15.	
May 25,	June 4,	June 15.	
May 25,	June 4,	June 15.	
May 25,	June 2,	June 11,	June 20.
May 25,	June 4,	June 15.	
May 25,	June 2,	June 11,	June 19.

Four jars, started May 27, have the following record:

May 27,	June 6,	June 15.	
May 27,	June 11,	June 15,	June 20.
May 27,	June 6,	June 15.	
May 27,	June 6,	June 15,	June 21.

Thirteen jars, started June 2, each jar being infected with four fungus-covered bugs from the preceding jars, are recorded as follows:

June 2,	June 11,	June 20.	
June 2,	June 11,	June 19.	
June 2,	June 11,	June 19.	
June 2,	June 7,	June 15.	
June 2,	June 11,	June 15,	June 20.
June 2,	June 11,	June 19.	
June 2,	June 11,	June 19.	
June 2,	June 11,	June 20.	
June 2,	June 15.		
June 2,	June 11,	June 19.	
June 2,	June 11,	June 19.	
June 2,	June 11,	June 15,	June 20.
June 2,	June 11,	June 15,	June 20.

One jar, started June 4, ran,—

June 4,	June 11,	June 20.

One jar, started June 5, ran,—

June 5,	June 15,	June 20.

Four jars, started June 6, are recorded,—

June 6,	June 15,	June 20.
June 6,	June 15,	June 19.
June 6,	June 15.	
June 6,	June 19.	

The bugs put into the jars on the several dates were from all parts of the chinch-bug district of the state. They were, for the most part, just received from the mail, and were in vigorous condition. They were kept supplied with green wheat. While the bugs were dying, at intervals of five to ten days, bugs in isolated check jars remained alive and vigorous.

By June 20 the demand for infected bugs was so large that the jar method of infection required more attention than we were able to give to it. The results of our separate lots were so uniform, and the sporotrichum so vigorous and ever-present, that the further watching of separate lots seemed useless; accordingly, June 20, a large glass case was arranged

with damp sand three inches deep over the bottom. About ten dead bugs covered with sporotrichum were scattered over the sand, and large quantities of live bugs from the field were put in, with plenty of green wheat. In nine days the bottom of the case was thickly sprinkled with white fungus-covered bugs, and in thirteen days only a few live bugs remained, and the case was restocked. The infection continued to work so rapidly in the case, that we found no trouble in filling from it twenty-five to one hundred orders daily. Vast numbers of young red chinch-bugs were put into the case, together with the adults, and they, too, were an easy prey to the disease. Minute points of white made their bodies conspicuous among the larger flecks of white where the adult bugs lay covered with sporotrichum. On June 28, *Empusa Aphidis* was first noticed in the infecting case. Up to this date it had not made its appearance in our laboratory. From this time to the middle of August it multiplied its victims in the infecting case. For a short time it became more conspicuous than sporotrichum, and then subsided.

On July 4 we began experimenting with common shallow dry-goods boxes for infecting cases. The inside of the boxes was sprinkled, and the bottom thickly covered with green wheat. A few fungus-covered bugs were sprinkled over the wheat, and new bugs from the field were put in in large numbers. Within a week the white fungus-covered bugs were thickly spread over the bottoms, and in places the white bugs were literally in heaps. Continued experiments showed that damp wooden boxes offered the best conditions for the development of the fungus, and the glass cases were no longer used. Sporotrichum, like most fungi, thrives best in a moist atmosphere, but an excess of water, such as occurs in a wet soil or along the sides of a glass case where the vapor often becomes condensed, is detrimental to its development. In the wooden boxes the atmosphere was abundantly humid, but water that was sprinkled in from time to time, or that became condensed on the sides of the boxes, was at once absorbed by the wood.

During July and August, sporotrichum continued to spread through successive lots of fresh bugs from the fields. *Empusa* was always present, but was not so conspicuous in its ravages as *Sporotrichum*. In the first weeks of September the disease began to subside, and at the present date (Oct. 13) neither sporotrichum nor empusa is spreading further. Nor is it at all probable that the diseases are lost. The observations on the life-history of these fungi, which follow, show that provision is made for a period of rest.

June 28 the spores of sporotrichum were transferred, by means of a sterilized needle, from the dead body of a chinch-bug to fifteen culture plates. The culture medium was a mixture of beef broth and Irish moss, enough of the mucilaginous decoction of the moss being added to the beef broth to give a solid medium at 80° F. Within forty-eight hours the spores had germinated, and branching mycelia could be seen spreading through the medium. Within three days spores were produced in

abundance, but only one spot on the fifteen plates was found to be a pure culture, *Aspergillus*, Mucor, and bacteria being mixed with all the other growths of sporotrichum.

From the one pure spot, spores were transferred to three new plates, and the resulting growths were all pure.

The germinating spore puts forth a mycelium, which branches as it grows. At intervals, mycelial branches shoot upward, and grow over the surface of the culture medium. Conidiophores arise from these; the conidiophore sends off branches, and the spores or conidia are abscissed from these branches in glomerule-like clusters. The average diameter of twenty spores thus produced was 2.3 micromillimeters. It is by means of these minute spores that the fungus is so rapidly disseminated throughout a field infested with chinch-bugs. These spores, however, soon lose their vitality (spores one month old would no longer germinate in our laboratory), and the fungus must make provision for its self-preservation during protracted periods of weather unfavorable to the development of conidial spores.

Culture plates in our laboratory, covered with pure cultures of sporotrichum planted July 9, show the mycelial branches within the culture medium to be swollen, at intervals, to a diameter of 3.9 micromillimeters, the average diameter of the unswollen mycelial branches being about 2.5 micromillimeters. It seems more than probable that this function of these hyphal bodies is to carry the fungus through the cold of winter or the drought of summer. Experiments have been started in our laboratory to test the germinating power of these bodies, but too late to give the results in this paper.

Resting spores are also found on the culture plates, having a diameter of 20 micromillimeters and a thickness of cell wall of 1.8 micromillimeters. Similar spores are found in the crushed bodies of chinch-bugs covered with sporotrichum. While it was found that pure cultures of sporotrichum could easily be obtained, repeated attempts to inoculate chinch-bugs from these cultures were unsuccessful.

As heretofore stated, *Empusa Aphidis* was first noticed in our infection case June 28. Eight or ten bugs were found covered with a vigorous growth of this fungus. This disease had probably been sent in from some field where it naturally existed. *Empusa* continued to multiply in the infection cases, and by July 12 it rivalled sporotrichum in the number of its victims. Active bugs, without external signs of the disease in the afternoon, would be found hanging to the wheat blades on the following morning, covered with a vigorous growth of empusa. If the fungus was kept undisturbed, it would keep on growing at the expense of the tissues of the bug until nothing was left save bits of the chitinous integument.

Attempts were made to obtain pure cultures of empusa, but without success. At first, bugs covered with empusa were placed on the surface of the culture mediums, in the hope that the spores would be thrown, as is

the habit with this fungus, and the growth of the spores would give a pure culture. The spores were thrown in a ring about the bug to a distance of a quarter of an inch, but a rapid growth of bacteria from the bug broke down the culture medium, and the empusa spores did not develop.

To keep the bacteria from reaching the medium, a cover glass was heated over a Bunsen burner until it became very much convexed; this was then placed on the culture medium, convex side up, and upon this were placed three bugs covered with empusa. A mycelial growth was obtained in this way uncontaminated with bacteria; but no spores were produced. We have been unable, then, to attempt the inoculation of chinch-bugs with pure cultures of empusa. That the fungus has power to spread rapidly from one bug to another, the experiments in our infection cases have clearly shown.

A chinch-bug covered with empusa seems to be studded with minute gray beads. A thin section cut through the body of a bug in this condition shows the body cavity to be crowded with the mycelial growth, and protruding through the integument are vast numbers of broad conidiophores, each bearing a single conidium.

It is by the sudden rupture of the conidiophores, due to turgescence, that the conidia are thrown to some distance.

Where the fungus continues its growth to the complete destruction of the chinch-bug, the whole mycelial mass breaks up into chains of bodies, varying each from 16 by 29 micromillimeters to 23.5 by 27.4 micromillimeters.

In one instance, resting spores, apparently, were found. These were round bodies, with granular contents and thick walls, and varying in diameter from 23.4 to 25 micromillimeters.

A chinch-bug that died of empusa about the middle of July, was confined in a moist atmosphere on a sterilized plate Oct. 10, and to-day (Oct. 13) the entire body is thickly covered with a new growth of empusa. It seems, then, that the entire body of this fungus breaks up into a resting condition, and is capable, whenever the atmospheric conditions will permit, of springing into new growth.

Careful experiments will be made in our laboratory this winter to test the capabilities of germination and duration of vitality of the spores and hyphal bodies of *Sporotrichum* and *Empusa*.

XV.

REPORT OF COMMITTEE ON DISPOSAL OF WASTE AND GARBAGE.

SUMMARY.

1. *Résumé of Work Being Done. Professor Delos Fall, Chairman of Committee, Albion, Mich.*
2. *Appendix* (a). *Proposed Forms of Ordinances.* (*Received too late for publication.*)
3. *Appendix* (b). *Collection and Transportation of Garbage and Refuse in Cities. Edward Clark, M. D., Buffalo, N. Y.*
4. *Appendix* (c). *Collection and Transportation of Garbage. Col. W. F. Morse, New York.*
5. *Appendix* (d). *Tabulated Reports of Health Officers.*

METHODS OF DISPOSAL.

6. *Appendix* (e). *The Merz or Vienna System described. Edward Clark, M. D., Buffalo, N. Y.*
7. *Appendix* (f). *The Rider Garbage Furnace described. Crosby Gray, Pittsburgh, Pa.*
8. *Appendix* (g). *The Engle System described. Col. W. F. Morse, New York City.*
9. *Appendix* (h). *Crematories used in England described. Rudolph Hering, C. E., New York City.*

Résumé of Work Being Done.

The Committee on the Disposal of Waste and Garbage was constituted at the Memphis meeting, 1887, and, under the chairmanship of Dr. S. S. Kilvington, of Minneapolis, made two valuable reports, which are published as parts of the proceedings of this Association at its meetings held in Milwaukee and Brooklyn. These reports form an important part of the present discussion, and should be referred to for a complete study of the question.

The present committee has held two meetings before coming to this annual session of the Association, one at Pittsburgh, Pa., at which time the Rider Garbage Furnace was visited and studied, and at which meeting the general plan of the conduct of the work was outlined and adopted. The second meeting was at St. Louis, Mo., where the new plant of the Merz Extractor and Construction Company was studied and a part of this report was prepared. The work has been organized and divided among the different members of the committee for special study. Some members of the committee have done their work; others have not.

In making the present report, there will, no doubt, be the repetition of some familiar and oft expressed facts; and still, in this question, as in

others, iteration and reiteration may be needful in bringing about a reform already too long delayed. The dangers are real; the victims due to neglect of this important question fall on every hand. Heaps of garbage continue to be disease-breeders, furnishing the proper conditions for the rapid growth and development of any disease germs which may lodge therein.

The processes of putrefaction and decay are better known to-day than formerly: these do not consist of mere oxidation, but in large part are due to the action of the bacteria of putrefaction and fermentation. Where these ordinary bacteria thrive, pathogenic germs may, and hence it follows that garbage accumulations are a constant menace to the public health. Forgetful of the well known biological law, that all living beings, including man, produce excretions which are poisonous to themselves, he still goes on accumulating masses of such excrementitious matters, until the earth, water, and the very air is charged with death-producing elements, afflicting not alone himself, but his family, the neighborhood, the entire community, or even the large city,—sometimes, by the carelessness of a single person, spreading disease broadcast over the whole land.

The problem is not different in kind, but only in degree, whether man is closely huddled together in the densest populated portions of a great city, or dwells apart from his fellows in the small village or country place. Serious harm may come to him in either case, if only some one is careless in regard to the proper care and disposal of his waste and garbage.

The excreta from a single person in Plymouth, Pa., contaminates the water-supply, and a city of eight thousand inhabitants is thrown into sorrow and distress;—1,153 persons, a large proportion of these being from the adult population, were sick, 114 of these died, and an expense incurred amounting in the aggregate to over $97,000. A method was adopted by which wastes from an iron mine in Negaunee, Mich., could be easily disposed of, a method which at this distance and in this presence seems monstrous, that of allowing these wastes to flow into the lake from which the city derives its water-supply, and the city is plunged into an epidemic of typhoid fever, long continued, death producing, and a reputation gained by the city which does not advertise it most favorably, at least not as a health resort. Forty thousand people in the United States die every year from typhoid fever. For every person who dies with this disease at least ten are sick; so there are sick in the United States every year from this one disease, on the average, 400,000 people. For every person that is sick, the time and attention of at least one other person is demanded, either as nurse or otherwise; then 800,000 in the United States each year are either suffering from, or attending those who are suffering from, this disease. You may go further in the computation. The average duration of this disease is about twenty-eight days, or in the aggregate 22,400,000 days. If money considerations could ever be placed alongside the value of human life, an easy estimate, at say one dollar a day for each of these, would show the financial aspect of the case to be something very serious

indeed. This from one disease. Add to this the large number of other filth diseases with their attendant sickness and death, and the problem before us for study at this time stands out in all its gigantic proportions.

THE GROUND COVERED BY THE REPORT.

The present report is one merely of progress, many points which have been raised not having as yet been discussed in any adequate manner. Progress has been made, and valuable material gathered, all of which will be handed over to the committee that shall be appointed at this meeting to continue with the work.

We are endeavoring to study over the entire ground,—from the case as it presents itself in the smaller town, to that of the metropolis; from the stand-point of the householder, merchant, and manufacturer, as well as from that of the municipal corporations in whose hands the successful accomplishment of the work finally rests; from the stand-point of those towns and cities which have a well established water-supply system with its accompanying sewers, to those unprovided with these appliances, and which are still depending upon private wells for their water-supply.

We have desired that those who are personally and pecuniarily interested in methods of final disposal should have a hearing, and an opportunity to establish their claims to the best solution of the problem; and at the same time we have desired that the people should be thoroughly protected as against the expenditure of public money invested in schemes which will inevitably result in failure to accomplish the desired end.

The report emphasizes the following features of the subject:

1. As primary to all other considerations, there should be the education and enlightenment of the people with reference to the dangers arising from the neglect of this question.

The committee, in their investigations, have become deeply impressed with the wide-spread indifference which still prevails regarding this subject, and they call on true sanitarians everywhere to use all their influence in moulding a healthy public sentiment which shall speedily work reform in this direction.

The people must be taught that the public health is not a thing to be tampered with. Reckless individuals must not be permitted to jeopardize their own and their fellow-citizens' lives by carelessness in the midst of disease-producing conditions. The committee urge the holding of frequent sanitary conventions, carried on by the state and local boards of health, in which careful instruction shall be given regarding the house and its surroundings, the relation of filth to disease, of the well to the the privy vault, of the house to the cesspool, etc., and of all these to contagious and communicable diseases. In large cities the public press ought to be teachers along these lines.

We do not go so far as Thomas Carlyle, who declared that every sick man was a rascal, but we do assert that there would not be as many

deaths from communicable diseases if there were not some rascality or ignorance somewhere; and this rascality and ignorance rest with the whole people,—a people who will spend thousands of dollars to maintain a standing army to protect us against foes with whom we ought to be at peace, and a pittance of twenty-five or fifty dollars per year as salary of a health officer to protect us against this army of disease germs; a people who will spend hundreds of thousands of dollars to protect the lives of fishes, and a hundred dollars to protect the lives of men, women, and children; a people who will spend thousands of dollars to maintain a fire department to protect our property, and will give the "sanitary fire department" a hundred dollars to protect the lives of the citizens of the state. This phase of the subject is emphasized in a paper by Dr. Edward Clark of this committee, which paper forms a part of this report.

2. The mayor and common council of the cities, the presidents and trustees of villages, local boards of health and health officers, prosecuting attorneys and the police, all have important relations to this question. These responsibilities they should feel and know, because of their intelligent study of the subject in all its bearings. Two courses are open to these parties: Either, they must inform themselves, and by their intimate knowledge of the subject be able to legislate for themselves, or they must place the whole management of these and kindred subjects in the hands of a well paid, enthusiastic, educated health officer, who shall have full control, with proper ordinances to enforce his views, with full and sufficient penalties for the violation of the law, and with the moral and financial backing of the officers of the law, without which his work will fail. In the opinion of the committee, the health officer, acting as the executive of a small but thoroughly informed and progressive health board, is the proper person who should have this power placed in his hands, and he should be held strictly responsible for thorough and effective work in this direction. Mayors and aldermen, as a rule, will not inform themselves properly. They are too busy in the administration of the financial matters pertaining to the city which they serve—matters which seem to them to overshadow mere considerations of public health. In all communities may be found from three to five public-spirited, well informed, intelligent sanitarians, who will be willing to devote time and labor in the capacity of a board of health. It goes without saying, that these men should be sought out and appointed from their peculiar fitness for the tasks they are to perform, and not from any considerations of party affiliations, or political beliefs.

3. The committee have thought that it would be helpful to those dealing practically with this subject, if some forms of ordinances should be suggested, which in a general way should serve as a model for cities which have not already formulated and adopted such rules and regulations. These proposed ordinances, bearing simply upon one phase of the subject, may be found in the appendix to this report. It follows as a matter of course, that in many respects these regulations would necessarily be modi-

fied to suit the particular needs of the particular communities adopting them. Suggestions for ordinances bearing on the collection and disposal of garbage, other than night-soil, will be found in Dr. Clark's paper on the collection and transportation of waste and garbage, which is also to be found in the appendix to this report.

By way of comment on this part of the report, the committee desire to say that, in their opinion, this body, the American Public Health Association, should raise its voice emphatically against the perpetuation of the old-fashioned. deep privy vault system, and the traditional earth-storage system. If it is necessary that a privy-vault be used, it should never be of greater depth than two feet, and should frequently be cleaned. Other than these should be completely abolished, not alone in those cities which by their sewer systems may conduct human excreta into the same, and so remove them from immediate power to produce mischief, but this reform should be carried into all villages and farming communities. The evils arising from the lack of attention to this are not confined to large and densely populated cities, although in such places the evil is greatest: the small village and hamlet, the country residence even, may give rise to serious epidemics due to lack of care in this direction. It is not too much to hope that one of the early results reached through the influence of sanitarians shall be that this plague spot, this relic of barbarism, shall be utterly wiped off the face of the earth. It certainly requires no argument to prove the objectionable features of the ground-storage system. In a city fifty years or more old and containing a population closely packed together, each four rods by six or eight, it may be, has its dwelling-house, and, accompanying it, a privy vault, cesspool, barn, and well, the former of these accompaniments reeking with their filth and odorous from decomposing excrementitious matters. The deep privy vault is a barbarous thing even in the country, with six or eight families or from twenty-five to forty persons to the square mile of territory: how much more objectionable when two or three thousand people occupy less than this amount of space, all depositing the waste of their bodies in the soil, often in close proximity to the well. An eminent sanitarian says that vaults and cesspools are accountable for nineteen twentieths of all cases of typhoid fever; and adds as his opinion, that "if the dry-earth system were adopted, typhoid fever, cholera, and other filth diseases would speedily disappear."

"Forty-two deaths from infantile diarrhœa in June. These deaths occurred in forty houses. It appears that all have privy vaults save two, and many of these houses were supplied with water from wells in close proximity to the cesspools and privy vaults."[1] Comment is unnecessary: "he who runs may read."

We may study to advantage some of the model by-laws of local government boards of cities in England which pertain to cesspools. One of these requires that cesspools must be at least fifty feet away from the dwelling. It must have no communication whatever with the drain from

[1] Annals of Hygiene.

the house (the attestations of makers and advocates of patent sewer-traps to the contrary notwithstanding), its walls and floors must be constructed of good brick-work in cement, thoroughly cemented inside, and with a backing of well packed clay of at least nine inches. Around and beneath the brick-work, the top of the cesspool must be arched over, and means of ventilation provided. Constructed in accordance with these principles, they are far superior to the practice of emptying liquid and semi-solid waste matters into the earth, quickly to make their way through the soil and into the well. It is, however, bad practice to store such material for any length of time in any receptacle, there to putrefy and generate noxious gases. They should be emptied frequently.

4. The fourth point which the committee desire to enforce is that by which correct methods are arrived at concerning the collection and preservation of garbage by householders, hotel keepers, etc., and the transportation of the same to the place of final disposal. Much of the annoyance complained of by the people, many of the nuisances, have arisen from the careless and imperfect manner in which garbage has been allowed to accumulate about the premises, the unsightly, foul-smelling receptacles used, and the open carts and wagons dropping their refuse along the way, and presenting to the eye that which is offensive in the extreme. These questions are discussed by Dr. Clark, and also by Colonel W. F. Morse.

5. As fundamental to the discussion of the practical handling of garbage, the committee found it necessary to have a common understanding in regard to the classification of material which should be regarded as garbage, and to which our study should be confined. An enumeration of these materials would include ashes, street sweepings, kitchen refuse from hotels and private houses, manufacturers' refuse, fruits, vegetables, etc., from groceries; manure, dead animals, night-soil, tin cans, bottles, etc. These wastes may be classified into (1) inorganic and (2) organic. Of the inorganic wastes may be mentioned ashes, street sweepings, certain forms of manufacturing refuse, tin cans, bottles, etc. The organic wastes include the vegetable wastes from private houses, hotels, and groceries, certain forms of manufacturers' refuse, the ordure of animals, the excretions of man, and dead animals.

As ordinarily used, and therefore as used in this discussion, the term garbage includes simply vegetable wastes, such as refuse from groceries, the kitchen, etc.; the term animal waste includes the ordure of animals, and the solid excretions from man; wastes from manufacturing establishments, and all inorganic wastes, may be included under the term refuse.

WHAT IS BEING DONE.

The committee have endeavored to obtain fresh and reliable information in regard to methods now in operation in the larger cities. To this end the following circular was sent to one hundred of the largest cities in the Union:

City of . . . . . *1891.*

Report by . . . . . *Official position* . . . . . .

1. Method employed for the disposal of garbage,

(a) Street sweepings . . . . . .

(b) Ashes . . . . . .

(c) Refuse from stores, manufacturing establishments, etc. . . . . .

. . . . . .

(d) Refuse from hotels . . . . . .

(e) Night-soil (if run into sewers, state where sewers empty) . . . . . .

. . . . . .

2. Does the city own the appliances for doing the work, and what was their original cost?

(a) Cremating or reduction works . . . . . .

(b) Horses, carts, etc. . . . . .

(c) Cost of maintenance . . . . . .

3. Is the garbage brought to the place of final disposal at public or private expense? . .

. . . . . .

4. On what kind of wagons is the garbage collected and conveyed to the place of disposal? . . . . . .

5. What is the cost, per mile, of collection and conveyance? . . . . . .

6. How much material is gathered daily? . . . . . .

7. What, in your opinion, would be the bulk of the waste matters, per inhabitant, if this work were thoroughly done? . . . . . .

. . . . . .

8. Is the matter of collecting waste and garbage made obligatory upon house-holders, store- and hotel-keepers, manufactures, etc.? . . . . . .

9. What parts of the garbage possess value, and in what form are they sold? . . . . .

. . . . . .

10. Where is the place of final disposal? . . . . . .

11. Have any nuisances arisen from this work, and if so, in what regard? . . . . . .

. . . . . .

12. How are the men engaged in this work appointed or hired? . . . . . .

. . . . . .

13. How can this branch of the public health service be improved? . . . . . .

. . . . . .

[*Use the back of this sheet for fuller replies, or other suggestions.*]

Replies were received from thirty-seven of these, but it would seem that owing to the form of the questions, lack of space on the blank for appropriate replies, or for other reasons, the replies are somewhat meagre.

For example, question 5, as to the cost per mile of collection and conveyance, received scarcely a reply. This is an important consideration, for until some method is devised by which garbage can be disposed of in the centre of the city, without creating a nuisance and giving offence, the garbage must be removed to some place outside the city limits, and the method which will do this work most expeditiously and most cheaply, is the method which will find favor. Scarcely any of the health officers sending replies could give any reliable estimate of the amount of garbage per inhabitant necessary to be cared for, if the work were thoroughly done. These two are mentioned, with their discouraging answers or lack of answers, to indicate how far we are from possessing such facts and figures, such statistics, as will make it possible to study the question in a scientific manner and from the economic stand-point. The replies which are received have been tabulated, and are presented in connection with this report, marked "Appendix C."

Taking a brief survey of the largest cities of our country, the facts are as follows, as showing what is being done toward the solution of this question :

In New York city the disposal of waste and garbage is not under the direction of the board of health at all, but the bureau of street-cleaning has entire charge of the work. The garbage and refuse are collected by the city teams, loaded upon flat-boats, removed to the sea, and dumped.

From the extremely business-like report of the general sanitary officer of the city of Chicago for 1890, we make the following extracts: The total cost of the scavenger service, from January 1, 1890, to December 31, 1890, was $253,140.72, for the thirty-four wards of the city, covering an area of 174 square miles, embracing 2,047 miles of streets, and about 3,000 miles of alleys. The service, as a whole, has been fair, but not an ideal scavenger service by any means. Outside of the first ward, which has had daily service, not to exceed a triweekly service has been performed. About 225 teams have been regularly employed by contractor and city, removing on an average 2,000 cubic yards of refuse per day : this refuse has been deposited in clay holes, removed by train beyond the city limits, and during the life of the "Chicago Garbage Reduction Co." (a private corporation), from February 19 to October 15, 1890, 7,208 tons of garbage were burned—thirty tons per day.

In the city of Chicago, from a careful estimate, there are at least 100,000 horses, making an average of 750 tons of manure every twenty-four hours (this does not include the stock-yards). This amount is not removed daily, of this fact I am well assured, nor will it be until manure becomes a commodity, not alone a fertilizer, but as a fuel. Our growth as a city, the gathering of a denser population, and the occupancy of the entire lot with buildings, will naturally tend to this. Manure, in all European and in many of our older cities, has a fixed value : it is carefully collected, baled, and stored until needed for a fertilizer or for fuel, then it becomes the old story of "supply and demand." The baling of manure is the ideal

manner of its disposal. The packages are clean, giving off no odors. It is easily stored without a sacrifice of valuable space, is economically handled, and its transportation by wagon or rail is obnoxious in no particular to the most fastidious. The total number of dead animals removed during the year, as shown by the secretary's report, was 24,419 (this does not include the stock-yards). The work has been faithfully performed,—sometimes, during the summer months, not as expeditiously as this department or interested citizens demanded, but as quick as humans, working day and night during the "hot wave" of July, could handle these putrid carcasses. The gathering of dead animals is not a profession or calling that most men are fitted for. I have tried it. I know it takes a stomach of iron, a total lack of the sense of smell, and the hauteur of a Sioux Indian to stand the repartee of the street gamin. Few men like it. I do not blame them. This is the reason, that, when it appears as if the department must have extra teams and actually need them, and have money ready to pay for them, you cannot, even in this great city, find the men who can or will collect dead animals. The animals are all removed beyond the limits of the city, and rendered.

The department secretary issued during the year 8,737 permits to clean vaults, and a conservative estimate bases the number of cubic yards removed at 21,843. The old-fashioned privy-vault, built in the yard in the rear of a building, is becoming, in progressive communities, a thing of the past. Still we find the old fogy who does not want improved water-closets in his house; and for many years to come, especially in the older portions of the city, this department will have the vault question to contend with. Permits must be granted, and some method must be employed so that this department will know positively where each load goes.

Philadelphia reports as follows:

The present system of collection and disposal of garbage has been tried for a long time, and has proved a failure, from the sanitary point of view. The garbage is removed, by a number of small contractors, in a very unsatisfactory manner. Many of these contractors dispose of it by feeding it to hogs, others mix it with other waste products for manure, and at times it is buried, or accumulated on the ground, awaiting slow decomposition. There is no longer any doubt as to the remedy, or rather the prevention, of these multifarious nuisances. It is cremation. A large number of cities and towns, here and abroad, are now employing this means of disposal of garbage with the most satisfactory results. It has everything to recommend it. It is economical, prompt, efficient, inoffensive, and completely sweeps out of existence offensive nuisances which harass communities that employ the old plan. The use of refuse for filling up sunken lots for building-sites is to be condemned, for the best of reasons. Dwellings built upon such soil cannot be healthful, and yet depressions are scarcely levelled with this heterogeneous mass before the builder commences his work of erecting houses.

From the Brooklyn report of 1888 the following information is gleaned:

Garbage and refuse removed to sea. Collections made from hotels daily, and from houses twice a week in winter, and three times a week in summer.

The disposal of stable manure has been a serious question with us, owing to the great number of horses employed in Brooklyn, somewhere in the vicinity of 26,000, mak-

ing, at a low estimate, some 182 net tons of droppings, which, with the particles of straw intermingled, brings the quantity up in the neighborhood of 200 tons daily. In the early spring the neighboring farmers removed it promptly, but as summer advanced the farmers, occupied in attending and marketing their crops, had no time, and its shipment in bulk was interfered with for like reasons. To enforce the ordinances under these conditions was impossible, practically. It was then suggested that experiments be tried to bale it, like hay and straw. A series of experiments, continuing from early spring until recently, was made under the directions of Dr. d'Homerque, and the result has demonstrated that when it was taken fresh and thrown into the box of the press until that was filled, and the bale stick and wires from the bales of hay or straw were used, the cost and time were, in large stables, not more than that of carting it to the manure pile. The cost of purchasing stick and wire was four and one half cents per bale. The advantages of this method are,—(1) reducing bulk into compact space; (2) preventing fermentation or fire-fanging, by reason of the compression, thereby enhancing its value as a fertilizer by retaining the ammonia; (3) the permitting its removal and shipment causing offence.

St. Louis report, 1889:

The former and existing methods of disposal of garbage, dead animals, and night-soil (where no sewers exist), are not such as meet the wants of our increased growth and advanced condition. The present mode of collecting the refuse from all portions of our territory, and conveying it to a few dumps and there discharging it, is very objectionable. A nuisance is created, and maintained by hauling offensive materials over the streets, and disease is engendered by dumping it into the river at its banks, where it is likely to lie or float a short distance, and lodge in greater or less quantities. This statement applies also to the night-soil removed from vaults in that portion of the city where sewers have not been constructed.

Dead animals are collected from all parts of the city, and hauled through the streets and across the river to a rendering establishment in Illinois. How long permission may be given for taking the carcasses of these animals to the locality where they are now disposed of, is a matter of great uncertainty, and is a question that might confront the municipal authorities at some very unexpected time, when they are least prepared to deal with it. The disposition of garbage and refuse material of cities is now receiving the attention and earnest consideration of sanitarians everywhere. Enlightened communities are earnest in their endeavors to determine the best method of preserving public health, by the most effective and economical destruction of filth accumulations. Of late years there have been constructed a number of crematories or furnaces, and extractors, in different cities, attended with varying success. Some of these aim at the destruction by fire in the easiest manner; others, looking at the commercial value as well as the final disposition, claim to be able to dispose of them by inoffensive and sanitary methods, and at the same time utilize their products. This subject is one that should now be taken into consideration by the authorities of this city, and if the matter is found practicable, the disposition of the dead animals as well as the garbage and night-soil (that has to be removed from vaults) should all be done at the same place, or at places set apart for that purpose. There has not yet been sufficient information obtained here concerning the latest process in use to give a definite idea of the best method to be pursued for the accomplishment of this important work; nor can that information be properly obtained without a personal inspection of the process in operation. Such observations should be made at the earliest day practicable.

This in 1889. Since that time a contract has been entered into with the Merz Extractor and Construction Co., this company agreeing to dispose of two hundred tons per day at ——— per ton; and of all gathered above that amount, free of cost.

Boston:

There are now about 350,000 loads of garbage, ashes, street-sweepings, and other miscellaneous débris gathered up by the city teams annually, and carted away to different places

and for different purposes. The annual cost to the city in hauling this large amount of material is about $500,000, more than $100,000 of which is spent in collecting garbage. With the growth of the city, and the gradually increased distance to which such matter must be carried for disposal, comes a corresponding increase in the expense. The question occurs to us, Cannot this growing expense be lessened, and much of the offence now attending the necessary storage of garbage in the houses and yards, and the hauling and carting of it in the streets, be avoided? It is found that with trifling cost in arranging the kitchen stove, each family can easily burn all its refuse as it is made and before it becomes offensive, and thus save all subsequent expenses and nuisances incidental to its being kept on the premises for several days and then carried through the streets by the city teams.

Baltimore:

The present mode of disposing of the garbage, night-soil, and street dirt of the city, as at present carried on, though far from perfect, is, with our present facilities, the best our circumstances will allow. The offal and filth of cities must be deposited somewhere when gathered from every house and locality, and is, from the very nature of things, a nuisance to those who reside in the neigborhood of the dumps. Much, however, could be done in mitigation of this evil by more stringent regulations in the manner of removing both garbage, ashes, and night-soil. The garbage carts are very poorly adapted, in their present construction, for the transportation of garbage and ashes through the streets of the city, and are a source of constant complaint by citizens whose olfactories are greeted throughout the summer months by the odor of decaying vegetable and animal matter, and at all seasons saluted by a shower of dust from uncovered ash-carts.

San Francisco settles the garbage question for 297,990 people in a very few words:

The proper disposition of the city's garbage should be promptly attended to. Many cities of Europe and the East have their garbage consumed in furnaces, it being found to be the cheapest and most expeditious manner of its disposal. I would, therefore, recommend that proper furnaces be built, and the garbage of the city be burned therein.

Cincinnati, the ninth city of the Union, with her 296,309 people, has the following to say:

On January 31, 1883, the city of Cincinnati entered into an agreement with the Cincinnati Desiccating Co., for a period of ten years, for the sum of $2,500 per annum, to perform the following work: to remove all vegetable garbage, dead animals, and slaughter-house offal which may accumulate within the corporate limits of the city of Cincinnati; and they further agree to pay the owners of dead hogs removed a price per hundred weight not less than one third of the value per hundred weight of live hogs of like weight and quality; and they further agree to pay the owners of dead cattle removed from three to ten dollars per head, according to weight and quality; and they further agree to pay the owners of dead sheep from twenty-five to seventy-five cents per head, according to condition and quality. They further agree to remove all animal offal from slaughter-houses and kitchens, within the limits of the city of Cincinnati; the price to be paid therefor to the owners thereof to be subject to the agreement between said owners and the Desiccating Co.; further, they agree to remove all dead horses, mules, dogs, etc., found within the city limits of Cincinnati. They agree to gather and remove all animal matter from private dwellings, boarding-houses, and hotels, at least three times a week, and all slaughter-house offal daily. Vegetable garbage, or offal, to mean kitchen vegetable matter unmixed with ashes or other refuse matter. Animal garbage, or offal, to mean soap-grease from dwellings, boarding-houses, hotels, and steamboats. Slaughter-house offal to mean the entrails and plucks of slaughtered animals, and tank stuff. Carcasses and dead animals to mean animals dying from disease or accident, and not to mean animals slaughtered for human food.

Cleveland :

A long delayed sanitary necessity remains unprovided in this city, to wit, a satisfactory gathering of house-garbage. No city of this size can be considered well taken care of which makes no public provision for this purpose. Private methods are entirely inadequate, and mainly efficient for the prompt and cleanly removal of such material. It is an old topic in these reports, but must continue to be urged until some relief is obtained. Whatever disposition is finally made of garbage, a systematic gathering should be inaugurated as speedily as possible. At present we are without funds for such service, but could money be better employed for the real welfare of our citizens?

Charleston :

For the past ten years the city of Charleston has, under the direction of the board of health, removed the garbage of the city. The carts, under the direction of a superintendent, leave the stables at six o'clock every morning. They are engaged in removing garbage until it is all removed. This is usually accomplished by noon. Every household is required by ordinance to put out in front of their doors, every morning, the garbage accruing on the premises. This is done every day in the year except Sundays. It has worked most satisfactorily. The authorities have entire and complete control of the carts. The drivers are held to a very strict account for their specified routes. The garbage is hauled to out-lying marsh lands to which salt water has flow every day. We have had no sickness in these sections. As to the cost. From noon until dark the carts are engaged in city work. These thirty-five carts do an immense amount of work for the city. I have stated the cost at $19,000 or $20,000. This is the total. Deducting about $10,000 for city work, the real cost for removing garbage is about $10,000. You can readily see what an advantage this method secures, at a minimum cost. We get all the work the carts can do, and there are no contractors in the business. It allows us to concentrate at a moment, as occasion necessitates. The streets of Charleston are kept exceptionally clean. We have been paving our streets with stone road-beds, Belgian blocks, for the past ten years, and the carts have been of great assistance.

Milwaukee :

The garbage (animal and vegetable matter from the table and kitchen) in this city is kept entirely free from street-sweepings, ashes, and other refuse. The city collects all animal and vegetable matter from the private houses, hotels, and restaurants only. The work is done by men employed by the city by the day. The cost last year of collecting was $23,316; the cost of disposal last year was $15,500. The disposal was by a company which had a contract with the city for three years, said company using the Merz or Vienna process. The contract has now expired, and the law requires that the common council shall enter into a contract for the disposal of the garbage,—and the matter is now before the council for consideration, and has been all summer. The Merz process was satisfactory to this department, but its location and management were not satisfactory, and a prejudice has been created against it, so that it is doubtful if that process will be used in the immediate future. At the present time the garbage is being dumped into Lake Michigan, much to the disgust of this department as well as to many citizens, but this, it is hoped, is only a temporary expedient. The street-sweepings and ashes are used at the present time for filling purposes on low land. Night-soil that is deposited in water-closets runs into the sewers, the sewers empty into the Milwaukee river, which is flushed out into Lake Michigan—another proceeding not approved by this department. Night-soil deposited in privy-vaults, of which there are about 20,000 in the city, is removed by scavengers to the adjoining farm-lands near the city.

Garbage is collected in wooden wagons provided by the men who collect it, which is not approved by this department. The amount of garbage daily collected at the present time amounts to about fifty tons. Commission merchants, fruit dealers, grocers, etc., are obliged to remove their own garbage.

In regard to question 13—"How can this branch of the public health service be improved?" I would state that I believe that air-tight steel carts should be adopted for col-

lection, that collectors should be hired by the city by the day and not by contract, that the collection should be under the control of the health department and by an officer possessing full police powers; that in the summer-time the garbage should be collected daily, preferably in the early morning hours, and in the colder months as often as twice a week; that a garbage plant should be owned and managed by the city government, and should be located on land condemned by the city, outside of the thickly populated part of the city; that if the city is over 100,000 in population, one plant for every 75,000 or 100,000 population should be provided, so that too large a business of this kind would not be conducted in the same locality. As to the methods of destruction, I believe the Merz or Vienna process the best and most economical ever yet devised for taking care of the garbage of 100,000 inhabitants or more. The only other scientific process with which I am acquainted, that promises anything, is cremation, and I have yet to see the plant, and I have seen quite a number, where the gases can be consumed and where the plant can be run without producing a greater nuisance than the Merz process. The Merz process has the advantage of converting the material into more or less valuable products in a commercial point of view, while cremation destroys everything except obnoxious gases. As a member of the American Public Health Association, I am decidedly opposed to your committee's rendering a final report on this subject the present year, for I believe improvements will be made within a very short time now, which will be of great value to citizens, and I believe the subject should remain open and that a report of progress only should be made.

District of Columbia:

The Collection of Garbage and Removal of Offal.—Table K presents a statement, by months, showing the number of dead animals, the number of tons of garbage, and the number of barrels of night-soil collected and removed during the year. The number of dead animals is 8,344, an increase of 390 as compared with 1889; the number of tons of garbage is 23,914, an increase of 1,880 over the year previous; and the number of barrels of night-soil was 20,554, a decrease of 1,115 as compared with the year previous. The decrease in the number of barrels of night-soil may be accounted for by reason of the fact that the sewers have been extended in many places, and water-closets have taken the place of the numerous privy-boxes. The increase in dead animals is almost entirely attributable to the number of dogs killed at the pound.

The large increase in the amount of garbage collected during the year may be attributed to an increased efficiency in the service, additional funds having been provided and an inspection force inaugurated. The sum provided at the present time is not, however, sufficient to secure a service such as we are attempting to perform, that is to say, the removal of all accumulations from dwellings tri-weekly, and from hotels, markets, and provision stores daily, when necessary. The contractor has employed during the year from fifteen to twenty-six two-horse wagons, with two men to each wagon, these wagons carrying eight barrels each, and making as many loads as possible per day. In addition to this service, I issued during the year 127 permits to itinerant gatherers, under conditions that the garbage would be removed by each from certain dwellings, these dwellings being specified, and the gatherer held to account for the regularity of collection and the general character of the transportation. These private collectors are to-day taking the garbage from 945 dwellings in the city. I am thoroughly convinced that if the city itself should take control of the garbage service and attempt to do the work which we expect of the contractor it could not be done for less than $30,000. This is a service which demands great care, and which causes no end of complaint. The inspection service has proven to be a very valuable addition to the work, and I shall expect to see it much improved during the coming year. I hope that congress may be prevailed upon to appropriate at least $25,000 for this service.

FINAL DISPOSAL.

The majority of health officers consulted on this subject favor the process of cremation, while some prefer the extraction or reduction process

by which the garbage is converted into commercial purposes. The Committee does not regard these as ideal methods for all forms of waste, and still they are not prepared to suggest at present any alternative which is so well settled even in theory, and still less in successful practice. Briefly stated, the attitude of the Committee is this: Different kinds of waste require different methods of treatment.

Of course, ashes cannot be disposed of by either of the above named processes. They cannot be burned, and, mixed with other garbage, they interfere very much with the burning. In the great majority of cases the practice is to use ashes for the filling of low lands, and this is entirely permissible, provided great care is taken to completely separate this from all kinds of organic wastes. The promiscuous dumping of vegetable and animal wastes upon low lands for filling purposes cannot be too strongly condemned. Covering them with a few inches or a few feet of earth does not necessarily destroy their power to harbor disease germs, which may be ready to spring out and produce an epidemic of disease at any time when favorable conditions shall have been established. Again, being already the products of oxidation, they cannot decompose and thus produce any of the evils incident to decaying and decomposing material. They are inorganic, mineral, and cannot harbor germs either of decay or disease. Clean ashes are not unsanitary products, and can therefore be safely used in filling low lands. For this they find constant use in every city. Street-sweepings, composed largely of dust and animal ordure, are useful as a fertilizer, and may be used as top dressing for lands that are being filled for building purposes.

For the vegetable wastes, garbage proper, the farmer will claim it as a privilege to take these home to be used as food for his cattle and hogs, while the keepers of hotels, boarding-houses, restaurants, etc., will claim it as their right to dispose of these wastes, if perchance they may realize a few cents or dollars for the same. The Committee regard it as a very doubtful sanitary proceeding to accommodate the milkman by allowing him to carry away decaying kitchen refuse to-day, and to-morrow return it to be used as food for children, in the meantime having passed through a foul, and it may be filthy, bovine laboratory called a cow. "This innocent economizing in parents may save a penny or two a quart on milk, but in return it will bring doctors' bills, disease, and it may be death." As to the manner of collecting and transporting this form of refuse, it must be insisted that if the farmer is allowed to carry it away, he must do it in the same kind of a wagon and under the same regulations as govern the hauling of all other forms of refuse.

The law of supply and demand seems to regulate fairly well the disposal of the ordure of animals.

According to the method proposed by Dr. Clark, garbage is stored in closely covered boxes, carried in these to the garbage-wagon which is also closely covered, and carried by the latter to the place of final disposal; and thus it never becomes visible to the eye from the time it is so

stored by the householder, until finally disposed of. The method is an ideal one, and at the same time perfectly practicable, and putting it into practice in our large cities will eliminate many of the disagreeable features from the whole problem.

The Committee design, if continued in this work, to make a study of all the methods now used for final disposal, informing themselves of the comparative cost of plants, the expense of operating, the capacity of works, the adaptability of the different systems to larger and smaller cities, etc., etc.

Respectfully submitted:

DELOS FALL, *Albion, Mich.*,
DR. GRANVILLE P. CONN, *Concord, N. H.*,
MR. CROSBY GRAY, *Pittsburgh, Pa.*,
RUDOLPH HERING, C. E., *New York.*,
DR. EDWARD CLARK, *Buffalo, N. Y.*,
} COMMITTEE.

APPENDIX.

"B."

COLLECTION AND TRANSPORTATION OF GARBAGE AND NUISANCE-PRODUCING WASTE IN CITIES.

BY EDWARD CLARK, M. D.,

Buffalo, N. Y.

The first great task that every municipality must undertake, as the initial step toward successfully solving the "garbage and refuse problem," is a thorough education of the masses on the importance and necessity of forever keeping garbage and all nuisance-producing refuse separate from street dirt, ashes, tin cans, bottles, old shoes, etc. This educational crusade must be carried on, in part by appealing to the moral and intellectual sensibilities of the public, and partly by compulsion. The more enlightened and cultured portion of our population, and those who have a just appreciation of the importance and necessity of observing hygienic rules and regulations, need only to have pointed out to them the unwise and dangerous practices to which many of them at times unwillingly resort, to have the evils speedily remedied. On the other hand, in all of our large cities we find a population, whose name is legion, made up of a conglomerate mass from different nations of the earth, who have almost no regard for personal cleanliness, and much less for hygienic requirements, many of whom seem to be in their most natural and satisfactory environment when surrounded by a filthy and nuisance-laden atmosphere.

It is to this latter class of individuals that the compulsory educational methods in hygiene must be applied. The foundation upon which a superstructure of compulsion is to be erected must be furnished by the municipality in the shape of rigid and severe ordinances, rigidly and severely enforced.

The ordinances relating to this subject, and indeed all health ordinances, should be definite and specific, and so simple that the wayfaring man, though a fool, need not err therein. They should specify what kind of receptacles are to be used for garbage and other refuse; that garbage and other nuisance-producing refuse must never be placed in the receiver for ashes, street dirt or sweepings, tin cans, bottles, old shoes, and other dry material.

The inspection forces of a city should be clothed with full police power, so that it would be almost impossible for any person to escape detection for violation of a health ordinance, and justice should be so righteously administered, that, upon convincing and proper evidence of guilt, the offender could not escape the penalty of such violation. The kind of vehicles used for the transportation of garbage and other refuse should be specified, and the collection and removal of garbage and waste should be done at specified times, always subject to the rules and regulations of the health department, and under the immediate supervision of some of its attachés, each of whom should be held to strict account for the manner in which the work under his immediate supervision is performed. In fact, the whole matter of handling and disposing of garbage and all nuisance-producing refuse should at all times be under the control and management of the city's health department,—this, for the reason that garbage, and all vegetable and animal refuse, are among the great nuisance-producing factors of the age; and, as I understand it, dealing with nuisances and their causation is the especial prerogative of a health department. The question of street cleaning, and the removal of ashes and refuse of all kinds, not animal or vegetable, may at all times be safely relegated to the supervision of other departments, but the question of dealing with garbage and dead animals—never. This belongs to the health department, as much as does the management of an epidemic of small-pox.

Perhaps it is not advisable for a municipality to own the plant for doing this work, for this implies a large and perhaps unprofitable investment, and necessarily multiplies the number of places to be filled by political preferment. As the amount of work to be done can be pretty accurately determined, it would perhaps be best and most economical for the city to let the work by contract. What I insist on is this, that, no matter who does the work, it should always be done subject to the regulations and requirements of the health department, and under the supervision of men connected with, and responsible to, that department.

Having said so much by way of preface, it is now my intention to go into detail, and offer, first, a few suggestions relative the subject of "receptacles for storage prior to the time of collection." The results of my studies and observations have led me to believe that by far the best receiver for garbage and refuse, and even for ashes, is a galvanized iron tank holding about two or three bushels; it should be strong, and firmly made, and provided with a tightly fitting flange cover. It should be portable, and for this reason should be provided with handles on either side. It should never be uncovered, except when absolutely necessary, and should be kept in the rear of the house, or in the basement areas or passage-ways, and never upon the street or sidewalk.

The collectors should be obliged to go into the yard or area, carry the receptacle containing the garbage and refuse to their wagon or cart, remove the cover, dump its contents, replace the cover, and carry the receptacle back to its proper place. This is necessary, as it will prohibit the householder or store-keeper from

setting out on the sidewalk, or at the curb-stone, his garbage- and refuse-barrels—a practice now altogether too common, and which ought to be prohibited by penalty under any and all circumstances.

I have in mind now a picture of a most beautiful avenue in one of our most beautiful cities, where on warm summer mornings a row of filthy, stinking, open garbage-barrels and boxes may be seen upon either side of the street waiting for the collector to come along and remove their contents.

They are placed at the curb-stone on the collection days, perhaps at five or six o'clock in the morning. The collector may get around before noon to gather their contents, and he may not. On an average, they stand for a period of five or six hours, fuming and stewing in the heat of the summer sun—an unsightly picture, a menace to the health of the passers-by, and a shameful disgrace to the city in which such a condition of things is allowed to occur. This picture is not overdrawn, and I doubt not its parallel can be found in most of our larger cities.

The same kind of receptacle as the one above described can be used for storing ashes, store-sweepings of all kinds, tin cans, bottles, old shoes, scraps of paper, etc., or perhaps a larger receiver can be used for some of this material. None of the materials above named should ever be thrown on the streets or sidewalks, but should be carefully carted away with the street dirt, and used for filling purposes. Decaying or rotten fruit and vegetables from stores and markets, and all confiscated meat and fish, should be subjected to the same rigid treatment as is the garbage from houses and hotels.

In many cities the large hotels derive quite a revenue from the sale of the garbage and table refuse to people who use it principally for feeding hogs. This is a practice to be condemned, but it is a delicate question with which to deal. I am of the firm belief that the health department of a city in which this is done should insist upon it, that, if sold at all, it should not be sold to, or fed to hogs or chickens by, any one residing inside the city limits, and that those who purchase the stuff should be compelled to remove it in the night, and in tight barrels or tanks similar to those used in many cities for transporting night-soil.

The storing and transporting of manure, or stable refuse, is a subject with which boards of health in our Eastern cities have little to do. This commodity is in great demand for fertilizing purposes by the numerous market-gardeners surrounding the cities, and, as the supply is hardly ever equal to the demand, it is eagerly purchased, and rapidly carted away into the country.

The owners of the carts or wagons used for this purpose, however, should be notified that these vehicles must be made water-tight, and have suitable covers, so that no part of their contents can escape on the streets; and any person using a cart or wagon, for removing manure, which does not comply with these requirements, should be subjected to a penalty.

There are many and diverse kinds of carts, wagons, and other vehicles used in different cities for the transportion of garbage and refuse from the place of collection to the place of disposal: a few of them possess some degree of fitness for the purpose, while many of them are imperfect, and inadequate for the work for which they are used. They are faultily constructed, not having any arrangement by means of which their contents can be quickly dumped. And many of them have wooden boxes, which are old and leaky, and, having no covers, their contents drip and drop along the streets, this creating and perpetuating a nuisance.

Whether carts, or wagons, are to be preferred for transporting garbage depends, I think, somewhat on the distance the material is to be hauled. I am of the belief that, viewing this matter from the economical stand-point, carts are preferable for short hauls, and wagons for long hauls.

Whichever vehicles are used, however, they should, without exception, have water-tight boxes, made preferably of boiler-iron, just heavy enough to give them the necessary strength. Both carts and wagons should be constructed so that their contents can be easily and perfectly dumped. They should all be provided with tight covers, either wood or iron, preferably iron with overlapping flanges. The use of canvas covers for a garbage-cart or wagon cannot be too strongly condemned. When the carts or wagons are dumped at the place of disposal, they should be thoroughly flushed out with a large nozzled hose, the water being carried at once into the sewer by proper arrangements for that purpose. The driver of the cart should attend to this duty, and if found going back after another load with a cart or wagon not properly cleaned, it should constitute cause for immediate dismissal. In a word, these carts should be kept so clean and free from odor that they would not afford any indications of the use to which they were subjected.

If the ideas above suggested, with reference to the construction and proper care of wagons and carts, be put in practice, it would seem that the unpleasantness arising from the carting of garbage and refuse might be reduced to a minimum. At any rate, "a long suffering public would be gratified, if not benefited, by seeing garbage-wagons and carts pass through the streets with their contents carefully covered, and return for fresh loads without offending one of the most valued senses."

The form of cart to which I give preference is a two-wheeled dump-cart, with a box made of boiler iron, hopper shape.

A short time ago, at Buffalo, N, Y., the mayor appointed a citizens' committee on street cleaning and garbage removal. He honored me by appointment on that committee, and I urged the use of such carts for short hauls. They are now in use by the street commissioner, and I understand they are perfectly satisfactory. The only objection to them is an absence of the iron cover. Another good cart is known as the "Flannagan automatic garbage-cart."

No matter what process is employed by a city for the destruction of garbage and refuse, the inhabitants in the vicinity of the works will bitterly complain of it as a nuisance, and rightly so, too, unless extra precautions are taken to keep the premises in a state of cleanliness, and to have ample provision for the immediate reception and disposition of all refuse that is brought to the place. Under no circumstances should garbage and other nuisance-producing refuse be dumped on the ground on under sheds about the premises. Immediately on being brought to the works, it should be dumped at once from the the cart or wagon into the dryers or furnaces, and not a pound of it be allowed to accumulate in and about the building. If this were done, I am quite satisfied that the multitudinous complaints about these places being colossal nuisances would grow rapidly and beautifully less. But so long as the arrangements for receiving and disposing of refuse remain as defective as they have been, and are, in most of the works, these complaints will multiply, and ere long the prejudice against them (the works) will become so deep-rooted that it will be well-nigh impossible to eradicate it. The works of the Merz

Co., at Buffalo, are located just outside the city limits, in what is known as the town of Cheektowaga. When they were first put in operation, a large amount of garbage was allowed to accumulate under the sheds in the rear of the works. This was brought about, partly by the deficient construction and limited capacity of the works (this being the first plant of the kind erected), and partly by the fact that tin cans and other substances had to be separated from the garbage before it could be introduced into the dryers. The people in the vicinity complained bitterly of the place, and the town board of health threatened to go into the courts with the matter unless the evil was speedily remedied. Owing to improved methods in collection, and promptness on the part of the company in perfecting and enlarging their plant, the evils complained of were removed, and I learn that the works have since been running day and night without any complaints being made against them. I cite this one case, with which I am perfectly familiar, in support of my statements. I doubt not that other cities have had a like experience. There seems to be an almost unanimous sentiment among health officials that during the night or early in the morning is by far the best time for the collection of refuse, garbage particularly. From inquiry, I also learn that nearly all are agreed that the garbage and refuse from hotels, restaurants, and boarding-houses should be removed daily, and that in the tenement-house districts, and in the thickly populated sections of a city, at least two or three collections a week should be made in the summer-time.

The above remarks embody the opinions I have formed as the result of my own studies and observations in this important department of sanitary science. When Professor Fall, the chairman of our committee, informed me what division of the work was assigned to me, I at once sent out a circular letter (of which the following is a copy) to the medical health officers of thirty-five of the largest cities in the United States and Canada, asking for information as to what was being done in this department in their respective municipalities.

BUFFALO, N. Y., Sept., 1891.

Dear Doctor:—I am preparing a report on the collection and transportation of garbage and refuse, for the next meeting of the American Public Health Association, and, if possible, I would be much pleased to have you furnish me, at your earliest opportunity, full and explicit answers to the following inquiries:

1. Have you a regular and systematic method of collecting and disposing of your garbage and refuse?
2. How many tons are collected daily, and at what expense?
3. Does the city do the work with its own plant, or is it done by contract?
4. What kind of carts or wagons do you use, and what do they cost, each?
5. Is it collected during the day, or at night?
6. How many collections are made each week in the thickly populated parts of the city?
7. What kind of receptacles are used by the people for storing the garbage until collected?

I would be pleased also to have your opinion on the following questions:

1. Do you think that cities should do this work under the supervision of the health department?
2. What are the best hours for collection?
3. What carts or wagons are best?
4. What are the best receptacles for use by the people until the time of collection?
5. Are wagons better for long hauls than carts?

Any information bearing upon these points, and also copies of any municipal law relating to the same, will be greatly appreciated by

Yours truly,

EDWARD CLARK, M. D.,

271 Franklin St., Buffalo, N. Y.

Most of the officials to whom the above circular letter was sent replied to the same,—some briefly, others at great length. I have annexed hereto such portions of their replies and opinions as have a direct bearing upon the subject with which this division of the report has to do, and which I think are a corroboration of many of the opinions to which I have given pretty positive utterance in the foregoing remarks.

Dr. Knight, clerk of the board of health of Hartford, Conn., says that in that city ashes and garbage are collected separately. The garbage is collected and removed by contract. Ashes are collected weekly, garbage three times per week. Covered tin cans are used for garbage receptacles when they are likely to cause offence.

Dr. Wingate, commissioner of health of Milwaukee, says that the garbage is kept entirely free from ashes and other refuse. All decaying fruit and vegetables, meat, fish, etc., go in with the garbage. Ordinary wooden carts or wagons are used for removing all of the refuse; they are provided with covers, and made water-tight. The teams, men, and wagons are hired by the city. Collections are made in the summer-time between 4 a. m. and 12 m; in the winter, between 6 a. m. and 2 p. m. Collections are made daily from hotels, restaurants, and boarding-houses in the summer-time, and from private houses at least twice a week. This custom does not vary much in the winter.

Owners and tenants are required by law to provide water-tight boxes as receptacles, which are mostly made of wood. He believes that this work should always be done under the supervision of the health department. Advocates early hours for collection, metallic tank or box receptacle, and recommends "Flannagan's steel cart."

Dr. J. S. Leal, health officer of Paterson, N. J., says that the work of collecting is let by contract; garbage and ashes are kept separate. Collections are made during the day, and open two-horse wagons are used. Three collections a week are made in thickly populated sections of the city. He recommends covered metal receptacles, and believes that this work should be done under the supervision of the health department. He prefers one-horse iron-covered dump-carts for transportation, and thinks during the night or early morning the best time for collection.

Dr. Wright, health officer of New Haven, Conn., says that garbage and refuse in that city is removed partly by contract, and partly by persons licensed for the purpose by the board of health. Wagons are used, holding about six barrels each. Collections are made about three times a week, from May to October, and twice a week from October to May. Barrels and boxes are used for garbage receptacles, but iron cans are recommended. He believes this work should always be done under the supervision of the health department, but thinks the contract system perhaps the most economical for the city.

Dr. Allen, medical health officer of Toronto, Ont., says that the plant for garbage collection belongs to the city. Some use barrels, others iron cans, and

others let garbage lie in heaps on the ground. He believes early morning the best time for collection, and recommends covered iron cans as best receptacles.

Dr. H. B. Horlbeck, health officer of Charleston, S. C., says that the work of removing garbage in that city is entirely under the control of the health department, where he believes it always should remain. He believes early morning the best time for collection, and prefers carts to wagons for transportation. Two-wheel open dump-carts are used, and are owned by the city. Collection is made daily, and barrels and boxes are used as receptacles.

Dr. Laberge, of Montreal, says that in that city garbage and ashes are mixed together, and about one hundred tons daily are collected by contract. Boxes and barrels are used as receptacles, but they must be water-tight. Open heavy wagons are used for transportation.

In San Francisco, the garbage is collected by private individuals, costing each householder from fifty cents to two dollars and fifty cents a month. Covered wagons and carts are used, and collections are made in the day-time. In some parts of the city daily collections are made, in others it is collected weekly. Galvanized iron barrels are generally used as receptacles. The board of health designates what kind of wagons and carts shall be used.

Dr. Gapen, health officer of Omaha, says that the garbage in that city is collected by licensed haulers. Wagons and carts both are used for hauling, and the only requisite is that they be water-tight. Collections are mostly made in the day-time, except in the central parts of the city, where it is done at night. Two collections are made each week. No particular kind of receptacle is used.

Dr. Gapen believes a city should own its own plant for doing this work, and that it should be under the supervision of the health department. He recommends galvanized iron cans as receptacles, which should be furnished by the department at cost. He believes the cans should be placed in the wagons, and a clean, empty can substituted for the one taken. Wagons and carts should be tight, and he thinks wagons better for long hauls than carts.

In Toledo, Ohio, the removal of garbage and dead animals is let by contract, at a cost of $10,000 per year. Closed water-tight wagons are used, which cost $120 each. Collections are made in the day-time, and on alternate days. No particular kind of receptacle is used. The health officer believes this work should be done under the supervision of the health department, and recommends closed iron cans as receptacles, and wagons for long hauls and carts for short ones.

Dr. H. F. Hoyt, health commissioner of St. Paul, Minn., says that in that city about thirty tons of garbage is collected daily, at a cost of $11,000 per year. The work is done by contract, and collections are made daily and tri-weekly. One-horse covered wagons are used; iron cans, barrels, and boxes are used as receptacles. He believes that this work should always be done by a responsible contractor, under the supervision of the health department. That the garbage from hotels, and in the business portion of the city, should be collected at night, and in the resident portion of the city before 9 a. m. Prefers carts to wagons for hauling, and recommends galvanized iron cans as best receptacles.

"C."

WHAT IS THE BEST WAY TO COLLECT AND REMOVE THE WASTE OF TOWNS AND CITIES, AND WHAT DOES IT COST?

By Col. W. F. MORSE,

New York.

This inquiry is frequently addressed to those whose business relations bring them into association with the civic authorities of cities and towns having in charge the business of collecting and disposing of garbage. They are questions which are being presented by a great number of places which heretofore have ignored the subject, and now find themselves compelled to give it attention. They are questions more easily asked than answered, and however much care and time may be employed in endeavoring to solve this municipal problem, there will still remain a vague and unsettled feeling that no definite and positive conclusion can be arrived at. The scavenger service of a city or town is one which involves a considerable, and in some cases a very large, expenditure of money, the control of a large force of men, the care of an expensive equipment, of teams, horses, stables, etc., and the great responsibility of the public comfort, its cleanliness and health.

Every other department of sanitation has been animated by a spirit of inquiry and investigation, which has led to the expenditure of great sums of money in trials of inventions, the publication of numberless volumes of theory, of many experiments in the ventilation of dwellings and buildings, of strenuous efforts to obtain the purest and most bountiful water-supply, of ordinances and laws to prevent the adulteration of food-products and supplies, and the building of elaborate systems of sewers. All these questions have received attention, but the subject of the cleanliness of the community, as affected by the presence of all classes of waste and refuse, and as governed by the more or less perfect or imperfect system of collection, removal, and disposal of all this waste, is a matter which has been left to care for itself in the great majority of places. Not until the civic officials are driven by the complaints and remonstrances of the public, and by the presence of an absolute and pronounced nuisance in their midst, do they take any effective step towards giving relief.

The method at present in use in most of the cities of the country appears to be an outgrowth of the crude and imperfect way which was originally employed when these places were small towns and villages. In the beginning, every person was allowed to dispose of his own refuse in his own way, and by common consent all waste matters were deposited in the back yards, by the kitchen doors, or in some outlying place—out of sight if possible, out of mind in any event—and no care was taken to destroy or cover it. In a short time there appeared, on the surrounding line of these towns, piles of waste matter, unsightly, unsanitary, and obnoxious. These accumulations presently became mounds of rotting refuse, giving off stenches and offensive gases, the breeding-places of the lower forms of animal life, which, even when covered over with earth, if used for the location of dwellings, formed a starting-point from which radiated infectious diseases.

Being without any sewage facilities, these villages and towns used the privy-vault as the only place for the reception of human organic waste, and annually or oftener the contents of these vaults had to be excavated and taken away. This work, disagrecable and filthy in itself, fell into the hands of parties having only the lowest order of intelligence, was performed usually without any oversight or attempt at disinfection or sanitary precaution, and they were at liberty to dispose of this offensive and dangerous matter in any way that best suited themselves, provided public attention would not be too much attracted by their methods. As the place increascd in population, so these methods of garbage and night-soil collection and disposal were simply extended to meet the requirements. There would be, possibly, an attempt at some oversight or supervision of the process, a policeman would have power to arrest offenders who made too public an exhibition of their refuse dumps, and occasionally the night-soil contractor would be fined for poisoning the earth and air which belonged in common to the community. This, in effect, is the way in which nine tenths of the cities and towns of the United States deal with this question of garbage and night-soil collection and disposal. Evidently there is need of reform, of the institution of better methods, and of the substitution of strict rules, in place of unlimited license in this direction.

The *amount* of garbage and waste to be collected is an interesting question. According to the report of the commissioner of street cleaning for the city of New York, the amount, per capita, of garbage, refuse, street-sweepings, and ashes yearly collected in that city, is about one cubic yard to every inhabitant. This takes no account of night-soil, which is carried off in the sewers. This estimate has been found by experience to be very nearly the quantity which is annually produced in the average American city. For purposes of a rough calculation it is easy to estimate one cubic yard per annum of refuse, garbage, and waste material generally for every person, and, while the kind or character of garbage may vary with the different localities, as a rule the amount which is annually produced will vary but little from this quantity.

The proportionate amount of the different classes of garbage is a question which can only approximately be arrived at. In New York it is estimated by the health authorities that in the winter season about seventeen per cent. of the total of garbage collection of the city, and in the summer season about twenty per cent., represents the animal and vegetable matter liable to putrefaction, which is garbage proper. In New England, where the house offal, as a rule, is collected separately from all other kinds of waste, the average of six cities shows that the percentage of putrescible matter, as compared with the whole amount of garbage and refuse collection of the city, is about twenty-two per cent. In the Southern cities, where the colored population consume an enormous amount of vegetable food, making a proportionate quantity of vegetable waste, the summer collection of putrescible matter will amount to twenty-five per cent. of the whole amount of collection. In six Western cities the percentage of putrescible matter in the garbage collection is estimated to be about twenty per cent.

From the mean of these figures, which have been gathered with some considerable trouble and difficulty, it may be stated that about fifteen to twenty per cent. represents the amount of animal and vegetable matter which is putrescible in character in the ordinary winter garbage collection of a city, and about twenty-five per cent. in the summer and early autumn months.

What is the Best Way to Collect the Garbage? Is it by the Contract System?

By this method a city or town makes a contract with a specified party to collect in his own carts the garbage, ashes, and refuse, and convey the same outside the city limits. Often a contract is made with the same party to sweep the streets and to convey away dead animals. Contractors are required to make collections two, three, or six times a week; to make these collections in a tight cart which will not allow any wastings or droppings on the streets, to keep this cart clean, not to allow it to loiter on the streets, and generally, according to contract, to perform the work in a way that is satisfactory to the department and to the sanitary inspectors. In almost every case the Health Inspectors' Department is at war with the contract service from the beginning of the work. Competition often brings the price down to such a figure that a very narrow margin of profit is left for the contractor, and this means not a sufficient number of teams and men to do the work, an evasion or non-compliance with the requirements of the city, or—a financial loss. Inasmuch as his object is to get over the ground quickly, to collect the smallest amount of garbage at the greatest price that he can get and keep just within the rules of the inspection service, unless he is vigilantly watched the contractor is very apt to instruct his men to hurry with their loads, to cover the allotted route quickly, and to get through in the shortest way possible. There is no special need, in his estimation, of keeping his carts clean; therefore there is always an effluvium surrounding these vehicles which heralds their approach. There is rarely, if ever, any attempt on his part to enforce the regulations of the city requiring deposit in separate vessels of garbage, ashes, and waste, and here is the critical place at which all well digested systems of improvement, the elaborate ordinances passed by cities, and the care and painstaking of its sanitary department, break down, and are of no effect or use, unless the contractor will coöperate with the authorities, instruct his men, and see that they carry out his orders of refusing to take putrescible matter when mixed with ashes. The pressure upon the contractor's employés to take whatever waste is set out from the household, the temptations offered by a "tip" or by persuasion of the householder to "take it away just this once," are so great that the usual result is a load of mixed garbage and refuse, ashes, and everything else, which no earthly power can thereafter separate into its constituent parts, nor wisely provide for the disposal of.

It has repeatedly occurred, that cities which have established a plant for the cremation of garbage have had difficulty and annoyance in satisfactorily operating this plant because of the wilful negligence of the contractors, or persons employed in collection of garbage, in refusing to assist in the enforcement of the ordinance requiring a proper separation by the householder.

It is the object of the contractor to do the least work and get the most money out of it; and from the nature of his occupation, and from the fact that he is dealing with worthless material, every man's hand is against him, and he has no inducement, except the bare fact of a money recompense, to give thoroughly good service. As a rule, he selects for his place of final disposal a dump as near as possible to his field of collection, and here he continues to throw every kind of abomination until driven out by indignant neighbors, when he migrates to some other point.

Under his system of dumping, at points near the city lines, the matter which he removes from the city is daily hauled over by people (men, women, and children) possessed with the idea that a garbage-dump is a gold-mine, requiring only to be thoroughly dug over to make the digger wealthy. As a natural result, quantities of worthless stuff are picked up, carried back into the town, to be again discarded and taken away by the contractor, and again carried out. Whenever it happens that a bit of cloth, an old garment, or any material which has been in contact with persons ill from contagious or infectious diseases, finds its way into this garbage-dump, it almost certainly happens that this is found by some woman or child, and, under the guise of "rags," is taken back into the city, to become a new plague-spot and breed a new attack of infectious disease.

This practice of allowing persons to pull over and recover from dumps articles which have been thrown away is one which should be strictly prohibited, and the prohibition enforced by every community which has any idea of caring for the protection of the health of its people. The spread of diphtheria has been traced directly to this practice, and no amount of warning ever seems to be of use.

NIGHT-SOIL COLLECTION.

Whenever a city or town has only limited sewerage facilities, the night-soil contractor becomes a man of some importance. The knowledge that organic waste of the human body has always been and always will be a poison to be guarded against, is a sanitary maxim which is slowly but surely making its way in the minds of the great public. Hence, it comes about that the removal of the contents of vaults and privies is done oftener now than in former years, and that the arrangements for the removal and disposal of waste of this kind have assumed of late years an importance which was far from belonging to them heretofore. Under the contract system employed in most places, a party is licensed to remove night-soil: he is authorized to ask only a certain amount or sum of money proportionate to the amount excavated; he is obliged to use a specified form of sealed barrel, and is supposed to keep these in a cleanly sanitary condition. He is required to do the work only at night-time, when it is supposed that the least offence would be given to the smallest number of people,—and there the requirements stop. The ultimate disposition of this mass of dangerous material is left to his own fancy. Being under no special oversight or regulation as to disposal, he takes it to some point where it is moderately certain he will not be detected—nominally outside of the city limits, but oftener within its border—and digs a narrow pit in the ground and deposits it therein; or, he may contract with a farmer to scatter it upon the surface of the ground, to be supposedly ploughed under; or, he may, as is done in some Northern cities, collect, at some short distance away from the boundary of a city, an enormous reservoir of this offensive material, and, by treatment with muck, earth, or tan-bark, allow it gradually to become deodorized and inoffensive.

Several years ago there were a number of establishments in this country for the manufacture of poudrette, a form of commercial fertilizer the basis of which was night-soil. The business was prosecuted with vigor, as it was supposed the returns would be very large, the principal ingredient costing nothing except the trouble to haul it to the factory. But it was presently discovered that the exceedingly offensive material with which they had to deal, united to the great cost of

manipulating it into a form which could be handled without nuisance, exceeded the value of the fertilizer when manufactured; and the business was run at a loss, and given up. In other words, the present state of the fertilizer business in this country, and the great variety of articles which are useful at moderate prices for the enrichment of the soil, do not allow the profitable manufacture of compost from organic waste.

In a similar way there have been, and are now, many attempts to produce a valuable product from garbage. It is customary at many places to haul out upon the adjoining farm-lands the putrescible animal and vegetable matter, ashes, etc., of the garbage collection, and to plough into the soil all these constituent parts that can be subjected to such process. This may operate as a means of getting rid of garbage, but as a process for the betterment of the soil for producing food-products it is a great mistake.

The best evidence on file from the agricultural experiment stations of the country, and from the reports of scientists abroad, is, that garbage in its raw state is not a fertilizer, and does not enrich the land. Moreover, there is a very strong and warranted prejudice against using the products of a garden which have been grown by the direct application in its raw state of night-soil and garbage as a fertilizer; and the statement has been made by those whose sphere of observation has been exceptionally good, that certain classes of vegetables betray by their taste and odor the presence of the nitrites upon the ground in which they were raised.

The collection, removal, and disposal of garbage for municipal corporations by contractors may be fairly successful under certain conditions, where heavy bonds can be exacted and strict oversight and inspection maintained; but as a general rule, the experience of the American cities has been to the effect that the contract system is unsatisfactory and objectionable.

THE MUNICIPAL SERVICE.

The other method of collecting and removing garbage is where the municipal authorities undertake the whole service. It requires the investment of a considerable sum in teams, apparatus, stables, etc., and the employment of a large number of men. But these teams and men can be, and often are, used for other branches of the municipal work, thus dividing the expense. The inspection service can be more exactly performed, and the responsibility for the cleanly and efficient collection from the household can be more exactly placed. The householder, if his garbage is not taken away, has a means of redress by applying directly to the city authorities, and they in turn know precisely whom to blame for the neglect, and are thereby enabled to apply immediate remedy. There is no referring a matter to a contractor, who refers it to a foreman, who interrogates the man who drove the cart,—thus filtering through three different channels and arriving nowhere at the end. The responsibility of employés, when they are the servants of a city, is greater than when they are working for a private contractor. Their terms of office are more stable, being dependent on their personal behavior. They are more apt to take pride in the efficiency and appearance of their teams, and it is certain that, under proper inspection, they do vastly superior and more thorough work. The responsibility for the cleanliness of the city comes directly upon the officials having control. The householder feels as though his interests are being better looked

after, and that his complaints are more quickly attended to and more promptly redressed.

A comparison of the reports of health officers of the different places in the United States affords positive evidence that the contract system is inferior to the method of direct control of the collection and disposal of garbage by the city or municipal government. Several of the larger cities, which heretofore used the contract system, are now about to resume direct control of their garbage collection; others, where the contract system is still in force, have before them the strong recommendations of their health officers that the contract method be set aside in favor of municipal collection.

The whole weight of evidence from experience and observation is directly in favor of the collection of the waste of a city or town by its own teams, under its own inspection, rather than by sub-letting to a contractor. There is, moreover, a better oversight of the final disposition of garbage when the city authorities are directly responsible for its disposal, since continual inspection is maintained down to the place where carts are dumped, and where the pile of refuse matter is finally deposited. It will not do to take away the household waste in a thorough way, in clean, covered carts, to transport it through the streets so that no chance of offence can occur, and then allow it to be dumped at some point where it will give offence to people surrounding, or may become a source of danger as the future foundation of streets or dwellings.

A perfect collection system will include,—

1. The division of the city into wards or districts of convenient size for collection and thorough inspection.

2. The appointment to each district of a sufficient number of sanitary inspectors, and of carts and men for the collection of garbage and refuse. In the summer-time, in this climate, a daily collection of household offal and garbage is almost a necessity. Under the hot sun, decay begins from the instant that any surface of raw vegetable or animal matter is exposed to the air, and goes on to a point where putrefaction renders the article offensive and obnoxious. But the point of decay which makes garbage offensive is not reached for some hours. Fresh garbage, meaning thereby animal and vegetable matter which will decay, is almost odorless, and, when in this fresh state, can be collected and hauled and deposited without any nuisance, provided the householder's garbage receptacle is kept clean, the cart in which the garbage is conveyed is thoroughly washed and disinfected, and proper care is taken to cover or enclose the carts in such a way as to prevent the escape of any of the material. Therefore a daily collection is always advisable during the heat of summer, unless the amounts are very small.

3. The issuing of a printed notice or circular, to be given to and posted up by each householder, containing information of the time when the garbage collection will be made at this particular place, and specifying definitely the description of vessels in which garbage, refuse, sweepings, and all waste matter will be received. This ordinance should provide a penalty against the depositing of ashes or non-combustible material in garbage receptacles. The householder will be instructed to provide a second vessel, which would contain the ashes and non-putrescible articles, the collection of which should be made by separate teams.

4. The city should provide for the collection of the ashes and refuse material once a week in summer, and two or three times in winter, as may be required.

The quantity of ashes in the garbage collection of a city or town, as a rule, is more than one half of the whole amount of waste in winter, and less than one fourth in the summer season. The object of the municipal regulations is to get these ashes for the city's use in filling lands and grading streets, and this can only be done by a strict enforcement of the regulations as to separation, and a continual inspection of the collection carts.

5. The collection cart should be, as a rule, of a capacity to hold one or one and one half cubic yards. Experience has shown that the cubic yard is the most convenient and available standard of measurement for city refuse. It is exceedingly difficult to tell the weight of a given quantity of waste, which may include a vast number of different articles or substances, each unlike the other. There is a standard of measurement by weight for household offal, which can be very nearly arrived at where this is kept separate from every other class of waste. One and one fourth cubic yards of garbage composed of household offal or "swill" will weigh 1,600 pounds, or a cubic yard will average about 1,200 pounds where it is mixed with the average quantity of liquid. On the other hand, three yards of garbage mixed with dry refuse might not weigh more than 1,200 to 1,500 pounds; so that, in computing the waste materials of a city as a whole, the cubic yard is the most convenient and most accurate standard of measurement. This collection cart, drawn by one horse, should be provided with a cover which closely confines the material and does not allow it to become scattered on the street.

6. An accurate account of the number of loads should be exacted from each driver, and thereby each man would be compelled to do his full quota of work. With a little experience it is easy to arrive at the quantity of garbage which a given number of people will produce for each season of the year, and economy of transportation and labor is maintained by keeping an accurate account of the amount collected. At the end of each month these separate numbers are collected and tabulated, and the report made to the proper officer. This system of garbage collection, under the inspection of the health officer of the city, who has, through his inspectors, absolute power of compelling the most thorough work, is the only one which will insure a cleanly, economical, and satisfactory gathering of the worthless waste and refuse of any community.

The collection of night-soil is a matter which is still more important, if possible, than the garbage collection, and one which, as a rule, receives less attention from the city authorities. Where a town or city is extending its sewer area, the matter of the vault or night-soil collection becomes of decreasing importance. Usually the regulations require that all new houses built upon the line of sewer shall be compelled to connect with the sewer, and it should be made imperative for every householder to do away with the privy-vaults and connect with the sewer whenever practicable. Modern sanitation has shown clearly that the larger number of the zymotic diseases are due to the contamination arising from the presence of the organic waste of the human body. Epidemics of diphtheria and typhoid are, as a rule, directly traceable to the poisoning of the water-supply and the atmosphere by the emanations arising from the defective sanitary arrangements connected with privy-vaults. The reports of health officers of cities and state boards of health are filled with protestations and warnings, pointing out the fact that the people are being poisoned by allowing vaults and cesspools upon the land which is occupied by dwellings, or where wells are sunk in proximity to them.

The final disposition of the contents of privy-vaults is a matter which requires the wisest care. Too often it happens that the vacant ground in the immediate vicinity of growing towns and cities is honeycombed with great pits containing vast amounts of organic waste, which become, when the ground is needed for purposes of dwellings, a positive danger as a source of infection. The soil takes up only such liquid particles as can slowly filtrate through it, the great bulk remaining very nearly in the same state as when deposited. At one of the government posts, where it was necessary to excavate the ground for foundations for new barracks, it was found that vaults that had been filled twenty years ago were in very nearly the same condition as on the day that they were covered over, no oxidation having taken place. In digging the earth for the foundation of a large block of buildings erected in one of the older New England cities, it was necessary to excavate the ground which had been covered by a house used as a dwelling for over one hundred years. An old privy-vault, dug at the time of the erection of the first house, and which had been covered over and not in use for a great number of years, was uncovered, and the contents were found to be in almost the same condition that they were on the day the vault was covered over.

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The report of the census of 1890, as contained in bulletin No. 82, upon the receipts and expenditures of the 100 principal cities of the United States, contains some very striking facts in this connection. It appears that while the "total ordinary expenditures" in these 100 cities is $235,064,127, the amount reported as expended for the purposes of "health" amounts to the sum of $2,280,317, less than one per cent. of the sum of the "ordinary expenditures" of each year. Taking examples out of a list: A wealthy New England city, whose annual expenditures are nearly a million, expended for the "health department" less than three tenths of one per cent. of the total sum; a Western city, expending nearly four hundred thousand dollars, paid about one twentieth of one per cent. for "health." Thus, the support of the department which has the care of the public health, the prevention of epidemic diseases, and the removal of nuisances, receives, by far, less money than any other department of municipal affairs.

An attempt has been made to bring together statistics of the cost of garbage collection, which might convey some adequate idea of the expenses attendant upon a thorough system under municipal control, but the information obtained is of so varied a character that accurate figures are impossible. Taking the largest city in the country, New York, as an example, the last report made by the Street-Cleaning and Garbage-Collection Department shows that in a population of one and one half million of people, one and one half million loads of garbage and refuse were collected, each load being about one cubic yard, and that the cost of collection and disposal of this amount was 81 cents for each cubic yard. This included the sweepings of the streets, the collection of ashes, and the collection of garbage and refuse, but had no reference to any sewage matter. The report also shows that about 18 cents represented the cost of disposal, taking a part on barges and dumping-scows about 22 miles by water and dumping it into the ocean, and disposing of the remainder behind bulkheads to fill low ground in the vicinity of the city.

It was expected when this paper was begun, that statistics of the cost of collection for the cities of this country, based upon the number of cubic yards collected

yearly, could be obtained, but it has been found impossible to proceed in this way, as the records of amounts collected, except vague statements of "cart-loads," are not to be had.

But following the rule for computation suggested by the health officers of Providence, R. I., who state that 15½ cents per capita represents the annual cost of garbage collection in that city, then a table of approximate costs for several cities can be constructed.

Boston pays 22 cents per capita, and sells enough garbage to reduce this to 17 cents;

Chicago,	24 cents.	New Haven,	8½ cents.
Memphis,	31 "	Haverhill, Mass.,	5½ "
Keokuk, Ia.,	25 "	Newport, R. I.,	20 "
Los Angeles, Cal.,	27 "	Charleston, S. C.,	18 "
San Antonio, Tex.,	30 "	Lynn, Mass.,	12 "
Montreal,	11 "	Milwaukee, Wis.,	17 "
Detroit, Mich.,	17 "	Toledo, O.,	13 "

Washington has paid 6 cents up to the present time, but as this amount was too small to reimburse the contractor, he has stopped, and the city is collecting its own garbage, at an estimated cost of $40,000 per year, or 17 cents per capita.

St. Louis is reported to collect its garbage at a cost of $20,000 per annum, or about six cents per capita, the smallest amount of any of the large cities; but this applies only up to the beginning of this year, or a little later, when another contract for the collection and disposal goes into effect.

Philadelphia furnishes no statistics by which the collection of garbage is kept in a separate account from the street-sweeping and ashes collection.

This is also the case with Baltimore, Cincinnati, Indianapolis, Omaha, and Kansas City. These few examples are quoted as giving the extremes of cost in some of the cities and towns. They may not be exactly accurate, but afford an approximate idea of the expense incurred. The value of such a table is obvious, and when extended, as it will be, to include 50 cities and towns, it will form a basis for comparison of great service to places desirous of establishing some system.

But there is another class of cities which should not be allowed to pass unnoticed. In many places, especially in the West, there is literally no method of collection in use which is under the control of the city. From the first, each citizen was allowed to use his own discretion in getting rid of refuse, and no attempt has been made to exercise any oversight, except to designate a dumping-place where waste might be thrown. Cities of 100,000 people have no organized collection system, with no machinery for waste disposal, are without a system of license even, and are constantly in trouble with complaints of garbage nuisances. The knowledge that some better state of things might be advisable is slowly breaking its way into the official minds, and they will presently be seeking information of the best methods. Is not this question one within the bounds and province of this Public Health Association? and would it not be an act of charity and mercy to set on foot such an inquiry as shall convey in a concise way a hint of the best methods, and the cost of the same, to these inquiring, benighted, yet willing and anxious souls?

"D."

REPORTS OF HEALTH OFFICERS.

Albany, N. Y., Lem. Balch, health officer. 1. (a) Public dumps, contractors; (b) ditto; (c) by contractors to special dumps; (d) ditto; (e) Hudson river. 2. (a) None; (b) private contractors; (c) cleaning streets, $8,000 to $9,000 per year. 3. Private. 4. Any kind, barrels, etc. 8. No. 10. Generally to farmers, to pigs, etc. 11. General nuisance, from improper collection and methods of removal. 13. By putting it entirely under official inspection, and doing away with private contractors. It has repeatedly been urged that proper methods for ultimate disposal of garbage be provided for, proper carts be required, and the householder be required to have the garbage ready for collection at certain times, in proper receptacles, and that the whole of this work be under the charge and control of the board of health. As at present done, it is not only inefficient, but more or less of a nuisance. It is also urged that all sewage be intercepted by trunk sewers, carried below the city, and disposal arranged for by which the solid matter be removed and a purifier effluent alone allowed entrance into the river.

Binghamton, N. Y., Dan. G. Barr, health officer. 1. (a) Collected by superintendent of the streets; (b) carted at intervals by property owners; (c) ditto; (d) swill removed by farmers near city; (e) into Susquehanna and Chenango rivers. 2. No. (a) None; (b) none; (c) do not know. 3. Private expense. 4. Tight box-wagons. 8. Only on order of board of health. 10. In low, isolated places. 11. No. 13. By establishing crematory works, and by systematic collection of house refuse and garbage.

Brunswick, Ga., Alfred V. Wood, secretary of board of health. 1. (a) Carted to crematory; (b) mainly used on premises; (c) carted to crematory; (d) ditto; (e) a few private sewers empty into river; bulk carted to crematory. 2. (a) $3,500; (b) owned by contractors; (c) $2.50 per day for fuel. 3. By contractor. 4. Dump carts with metallic lining. 6. 10 to 15 loads. 7. 25% more than is now accomplished. 9. None. 10. Cremation. 11. No nuisance so far as to crematory, but much dissatisfaction at times with methods of scavengers. 12. By contractor. 13. By the work being done by city under a competent superintendent. (City pays contractor $300 per month, he furnishing everything, and having an average haul of one mile.)

Burlington, Ia., C. E. Barnes, commissioner of health. 1. (a) Dump; (b) dump; (c) river; (d) ditto; (e) ditto. 2. (a) None; (b) none. 3. Private. 4. Air- and water-tight barrels. 6. 15 tons daily. 7. 3 pounds. 8. Yes. 9. Farmers sometimes collect kitchen refuse. 10. Principally the river. 11. No. 12. Sanitary inspectors and dump-boat crew. 13. Cremation. In towns on so large a stream as the Mississippi river, cremation of garbage is a thing of the future. Our "dump-boat" carries all offal that does not tend to obstruct navigation, to a point in the stream below the city. Ashes, manure, street cleanings, etc., are deposited on a spot for that purpose, at the edge of the city. Dump-boat is used from 3 to 9 p. m. Owned by private parties.

Cambridge, Mass., Edwin Farnham, medical inspector of board of health. 1. (a)

Sold for filling; (b) ditto; (c) ditto; (d) there are practically no hotels; (e) sewers which empty into river. 2. (a) None; (c) street-sweepings, other than offal, are collected by the street department, at a cost of about $15,000 per annum. The house offal is collected by the overseers of the poor, and sold, or given to pigs kept at almshouse. The street-sweepings are collected in carts that can be covered with canvas covers; the offal wagons have wooden covers, hinged so that a part can be raised. The ashes are put in barrels, and placed on sidewalks by the householders once a week, and taken away the day they are put out, different sections of the city having their allotted day. House offal is also placed in separate receptacles, and carried off twice a week, except in summer, when the rule is to cart three times weekly. Street department has 9 horses and carts. Overseers of the poor have 12 horses and carts. Cost of collecting offal in 1890 was $18,000.

Charleston, S. C., H. B. Horlbeck, health officer, 1. Hauled out of city. (a) Used for filling; (b) ditto; (c) if objectionable, hauled out of city, if not, filling; (d) hauled out of city, hog feeding, etc.; (e) hauled out of city. 2. Yes. (a) None; (b) carts; (c) $19,000 to $20,000. 3. Public. 4. Carts, 2-wheels, dumping. 6. Average, about 100 loads daily. 8. Yes. 10. On waste salt-marsh lands. 11. None except odors, and it is deposited generally away from inhabited sections. 12. Hired by the city.

Chicago, John D. Ware, commissioner of health. 1. By contract. (a) By street department; (b) scavenger contract; (c) disposed of by owners; (d) ditto; (e) carried out of city. 2. No. (a) No. 3. Cleaning by wards by contract. 4. Tight-body wagons, canvas covers. 6. About 300 tons. 8. Yes. 9. None, except ashes for filling. 10. Garbage, outside limits. 11. No. 13. By the city owning and operating its own teams.

Columbus, O., W. A. McDonald, secretary. 1. (a) Dumped on vacant lots; (b) hauled out of city; (c) ditto; (d) ditto; (e) dumped out of city. 3. Private. 4. Air-tight wagons. 5. Private. 8. Yes. 10. Out of city. 11. Yes; not hauling before too much accumulates. 12. All private. 13. By the city government controlling it.

Council Bluffs, H. B. Jenning, health officer. 1. (a) Dumped outside city limits; (b) ditto; (c) ditto; (d) collected by men to fatten hogs; (e) into Missouri river, below city. 2. No. (a) No. 3. Both. 4. Tightly covered box. 5. Can't say. 6. Ditto. 8. Yes. (a) Not at all. 10. Outside city limits. 11. No. 12. Give license. We require scavengers to give license and bond. They keep alleys clean, and collect of property owner or occupant who caused refuse to be thrown in alley or street. All such material is dumped outside city limits.

Denver, Col., H. K. Steele, health commissioner. 1. (a) Dumped on River Platte; (b) ditto; (c) ditto; (e) into Platte. 2. No. (a) No; (b) no; (c) hired at $4 per day, cart and driver. 3. Public. 4. Iron or steel tanks, size 10 by 2 by 3 feet. 5. Do not know. 6, 7. Of garbage and filth in streets there are, on a rough average, about 85 tons gathered, being 28 wagon loads garbage and 32 alley cleanings. This does not include privy-vaults, cesspools, and dead animals. We average 30 permits for cleaning privy-vaults, cesspools, or grease traps daily. This would add 30 tons more to the 85,—total, 115 tons, or about 2 pounds to each inhabitant; the average would not much exceed this if thoroughly done. 8. No; hotel keepers and manufacturers generally remove their

waste and garbage. 9. All thrown into the river; the tin cans can be sold to the smelter for $5 per ton. 10. River. 11. The river, at times low, does not carry off the material, and the odor is the principal nuisance: it must be changed. 12. Night-soil is removed by private parties; garbage carts employed by the board of health. 13. That is what we are earnestly seeking to ascertain, and are giving it much attention, but have not decided what is best. Have several methods in view; city tried the Merz system, but injunction was served to prevent its use.

Detroit, Mich., Samuel P. Duffield, health officer. 1. Merz system. (a) Taken care of by the board of public works; (b) board of public works fill up low places; (c) taken away at their expense; (e) night-soil from privies taken outside of the city. 2. Does not own contracts. (b) Furnished by contractor; (c) about $36,000. 3. By contractor. 4. Closed water-tight wagons. 5. Not known. 6. From 55 to 60 tons in summer; less in winter. 7. At least one fourth more. 8. Garbage, yes. 9. Grease extracted and sold; residue sold to fertilizing company. 10. Everything worked up. 11. Yes; odors from works; having a suit now in courts. 12. Hired by contractor. 13. This will be a subject of paper from my pen next year. City is now on the point of again letting contracts. I cannot inform you at present whether the old system will continue. or whether a new contractor will have it this year. The garbage question is the greatest annoyance to a health officer.

District of Columbia, health officer. 1. (a) By contract, cars; (b) removed by private persons; (e) Potomac river. 2. (a) None; (b) hired. 3. Public. 4. 2-horse wagons, 8 and 10 barrels to wagon, 8. No. 9. None sold. 10. Outside district limits. 11. Yes; odors caused by delays or dereliction of collectors. 12. By the day. 13. We are in search of that information.

Dubuque, Ia., I. S. Bigelow, health officer. 1. (a) Used for filling lowlands near river; (b) ditto; (c) ditto, except organic matter liable to decomposition; (d) hauled off by farmers, or dumped into river below city. 2. (a) No; (b) no; (c) no. 3. Public. 4. Tight box. 5. Don't know. 6. About 5 wagon loads. 7. Double the present, that is, 10 wagon loads for 31,000 people. 8. Yes. 9. None sold. 10. In river below city. 11. Yes; carelessness on part of citizens, and also garbage collector in collecting garbage. 12. Hired by the city. 13. By compelling sewer connection and increasing penalties for removing garbage. The city hires a garbage collector at so much a month for 6 months of the year. No garbage removed by the city during other 6 months of year. The city twice a year cleans all alleys of garbage and refuse material, and collects from each resident a voluntary contribution not exceeding one dollar. Some people are careless about throwing ashes etc. in alleys, and the ordinance preventing same is not rigidly enforced. It is found difficult to enforce it unless person is caught in the act.

Elizabeth, N. J., E. G. Putnam, health inspector. 1. Carted away; (a) ditto; (b) ditto; (c) ditto; (d) ditto; (e) taken in closed barrels to almshouse farm, outside of city limits. 2. Do not own them. (a) No; (b) no. 3. Public. 4. Wagons with high side-boards. 5. Costs city $4,600 annually. 6. Probably 10 tons. 7. 25 tons for the whole city of 40,000 inhabitants. 8. Yes. 9. None. 10. Lowlands outside city limits. 11. None. 12. Hired by scavengers appointed by the council. 13. By cremation. Trying to persuade city council to

adopt ordinance compelling citizens to separate ashes from garbage. Will not be done at present. Hope to have a crematory soon for garbage, etc.

Elmira, N. Y., E. A. Reilly, health officer. 1. (a) Gathered by city teams and dumped into lowlands; (b) ditto; (c) the proprietors are obliged to cart them outside of city limits; (d) gathered by owners of hogs outside of city; (e) into Chemung. 2. (a) Have none. 3. Private. Fire-department teams and wagons remove street-sweepings and ashes. 4. Common dirt wagons. 5. Do n't know. 6. Unknown. 7. Never had an occasion to judge, the work being done by the inhabitants instead of officially. 8. Yes. 9. None sold. No value from our poorly arranged system. 10. Beyond city limits in lowlands. 11. None that is brought to my attention except its apparent general crudeness. 12. By private individuals. 13. By establishing a regular system of garbage under the direction of the board of health, and not as now carried on by individual arrangement.

Findlay, O., Charles Shirtliff, health officer. 1. (a) Have none; (b) ditto; (c) they have it hauled to city crematory; (d) hauled to crematory; (e) about 60 vaults empty into sewers running into river in heart of city. 2. No. (a) Crematory; (b) no; (c) crematory; about $1,400 per year. 3. Both. 4. Barrels in wagons. 6. About 16 yards street garbage and 30 barrels night-soil. 7. Can't say. 8. Yes. 9. None. 10. One mile east of city. 11. No. 12. Hired. 13. By the city's having horses and wagons paid by city to collect garbage.

Hartford, Conn., W. N. Knight, clerk of the board of health. 1. (a) For filling out of city; (b) used for filling; (c) garbage carted out of city and used as fertilizers; others are collected separately; (d) ditto; (e) carried out of city for fertilizers. 2. No. (a) None. 3. Public. 4. Large wooden boxes on wagon. 5. Garbage collected by contract, $7,000. 7. Do n't know. 9. Can't tell. 10. Outside of city. 11. No. 12. Hired. 13. Can't tell. Ashes are collected weekly by hired men, horses, and carts. Garbage, etc., collected tri-weekly by contract.

Kalamazoo, Mich., C. Van Zwaluwenburg, M. D., health officer. 1. (a) City gathers, and uses for filling low places; (b) used for filling and private roads; (c) all inoffensive is used for filling; others taken out of town; (d) swill used for hogs of town; (e) farmers use as manure or cover on farms. 2. (a) No; (b) no; (c) hire one team besides the two regular. 3. City only gathers from streets and alleys. Other is private. 4. Some closed; some opened. 5. Not known. 8. Yes. 9. Nothing sold. Swill is used for hogs. 10. Owners of hogs gather. 11. Swill is left on persons' hands too long. People need urging to keep clean. Alleys left in bad condition. 12. Commissioner on streets hires wagon and men mentioned above. No others. 13. The city should do all the work.

Lawrence, Mass., William L. Reed, clerk. 1. (a) Street department; deposited on vacant land; (b) deposited on vacant land; (c) ditto; (d) ashes' same as (b); swill sold by contract; (e) part into sewers. Merrimack river. Part in vaults removed by odorless excavation, and by pitting, and by taking into country. 2. Yes, about $3,000. (a) None; (b) 18 horses, 7 ashes-, 3 swill-, and 5 night-soil-carts; (c) $25,000 per year. 3. Public. 4. Covered 18 inches (cubic). 7. 2 cubic inches per man per year. 8. Yes. 9. Swill sold by contract $2.60 per cord, delivered by us to the swill-house. 10. Sold to farmers. 11. Yes. Garbage on dumps creates smell and disease. Everything should be cremated. 12. Hired. 13. By burning waste matter.

Manchester, N. H., Joseph B. Sawyer, member of board of health. 1. (a) Done by highway department; used for filling streets; (b) carried away by highway department; used for filling; (c) waste paper and rubbish (dry) is removed with the ashes; (d) water closets are connected with the sewers which empty into the Merrimack river. Contents of privy vaults are carried away to the farms in the suburbs of the city by two licensed parties. They get their pay from the owners of the vaults and farms. The contract price for removing swill, including all the more perishable material, such as worthless fruit, vegetables, and animal substances, is this year $1,900; last year it was $4,900. The work is done in a manner only passably well. He carries the stuff more than two miles into the country, and dumps it in a hog pasture. It is well away from other people, and his place has not as yet been complained of. This is his first year. 2. (a) None; (b) not known; (c) not known. 4. Ashes, street-sweepings, and dry rubbish on dump-carts. Swill in closed four-wheeled wagons. Night-soil in closed tubs and air-tight tanks. 5. Not known. 9. Only the swill and night-soil, and of these the value is small. 11. The city dumps are usually offensive, owing to the decay of the rubbish. There are occasional complaints of the dumping of night-soil in the city suburbs. 12. The board of health licenses the vault-cleaners. The superintendent of streets hires his men, who remove ashes and rubbish. The mayor and aldermen let out the swill contract. 13. By putting the whole, except perhaps the street cleaning, into the hands of the board of health. We think also by burning all except the night-soil in a furnace.

Milwaukee, Wis., U. O. B. Wingate, M. D., commissioner of health. 1. (a) Kept separate from other garbage, and used for filling; (b) ditto; (c) Merz system has been employed; (e) removed by scavengers to adjoining farm lands. 2. (a) No; (b) employed by city; (c) $15,500 last year. 3. City. 4. Wooden wagons. 5. Don't know. 6. 50 tons. 8. Yes. 10. Out of city. 11. Yes. 12. City. 13. See letter.

New Orleans, La., Lucien F. Saloman, M. D., secretary of board of health. 1. (a) Dumped into Misissippi river below the city; (b) ditto: (c) ditto; (d) ditto; (e) ditto. 2. (a) None; (b) ditto. 3. Public expense. 4. Carts. 8. Yes. 10. Mississippi. 12. Hired by the government. 13. By the cremation of garbage and the sewerage of night-soil.

New York, W. A. Ewing, M. D., sanitary superintendent. 1. (a) Used as filling vacant lots and behind bulkheads in suitable localities, also dumped at sea; (b) ditto; (c) ditto; (e) run into sewers, North and East rivers. 2. (a) None; (b) none; (c) none. 3. Public. 4. Carts, covered with canvas. 5. Do not know. 6. Do not know. 8. No. 9. Not sold. 12. By street-cleaning department. 13. By cremation.

Omaha, Neb., Clarke Gapen, commissioner of health. 1. (a) Dumped into lowlands and river; (b) ditto; (c) dumped into Missouri river; (d) mainly the same; (e) into the Missouri river. 2. No. (a) None; (b) none. 3. Private. 4. Various kinds. 8. Yes. 9. None. 10. Missouri river. 11. The delays and difficulties of removal. 12. Licensed. 13. By the city owning its own teams and removing the garbage itself under the direction of the health department, and the cutting off of councilmen's meddling in such matters.

Pittsburgh, Crosby Gray, chief clerk of the department of public safety. 1. (a) Used for filling streets and low grounds; (b) ditto; (c) ditto; (d) a portion

is removed to the country and used for feeding swine, a portion—together with that gathered from residences—is taken to the garbage furnace, balance is mostly deposited in rivers, etc.; (e) many of the privies and water-closets are connected with sewers, which discharge into the rivers, the balance are emptied by night-soilers, who deposit the contents in the rivers. 2. (a) $3,500; (b) no; (c) including salaries, repairs, running expenses, etc., during 1890, about $12,000. 3. Private expense. 4. Wooden boxes, wagons, and carts. 8. No. 11. Great nuisance, arising from deposits at places other than furnace. 12. Six men, at garbage furnace. 13. By compulsory collection, removal, and disposal under contract, at public expense; or by the city owning the appliances, etc., and doing the work. Collections should be made daily during the heated term, and three times per week during the balance of the year, removal to be made by means of air-tight iron boxes or tanks.

Portland, Me., Geo. C. Burgess, secretary of board of health. 1. (a) Gathered by street department; (b) disposed of by householders, etc., themselves; (c) owners must dispose of it themselves; (d) sold to milkmen and others to feed swine; (e) sewers empty into tide-water; night-soil from privies taken out of the city. 2. No; the work is done by contract; $350 per month for collecting house and fish offal. 3. At private expense. 4. Water-tight covered carts. 5. About $81.81 per mile per annum. 6. Average about 15 loads. 7. More than twice as much. 9. The garbage is all fed to swine. 10. Out of city. 11. The work is not done under any proper supervision, and complaint is made both as to its collection and disposal. 12. By the contractors. 13. By placing it, with full power, in the hands of the board of health.

Quincy, Ill., W. K. Haselwood, secretary of board of health. 1. (a) Dumped in out-of-way, low places; (b) ditto; (c) ditto; (d) garbage part sent to city dump in river, below city; (e) part runs into sewers emptying into Mississippi river, balance hauled in tight carts to city dumps; work done at night. 2. No; (a) none; (b) private enterprise; (c) contract from May 15 to Oct. 1, $165 per month. 3. Public. 4. Tight box-wagon, also wagons with tight barrels. 6. An average of eight 2-horse loads. 8. Yes. 9. None sold. 10. City dump in Mississippi river, at lower southern extremity of city. 11. None. 12. Contract let to lowest bidder. 13. Only one third of the city is in the scavenger district, and the service might be improved by including the whole city. We are extending our sewer system service, which is a great help.

Richmond, Ind., Jas. F. Hibberd, county health officer. 1. (a) Dumped into ravines; (b) ditto; (c) ditto; (d) removed by contract; (e) largely into sewers; and thence into river; remainder by night-carts into the country. 2. No. (a) No; (b) used by contract. 3. Public. 4. Tight wooden wagons. 5. $1,815 per year. 6. No data available. 8. Yes. 9. Nothing sold; much taken by private parties to feed hogs; remainder removed by contractor. 10. Farms in the country. 11. Some complaints have been made, by neighbors of hog feeders, of noisome odors. 12. By contract. 13. By the cremation of all offal not fit for fertilizers. This service in the city is not under my personal management, but I am fairly familiar with the details of the work. Our city has a population of 16,608, is situated on a plain 60 to 80 feet above the bed of the river, which runs in a comparatively narrow channel, with their rocky banks. It is maintained in a good sanitary condition by a live city board of health.

San Francisco, Cal., J. Haesch, secretary of board of health. 1. (a) Public dump scavengers; (b) ditto; (c) ditto; (d) scavengers; (e) bay of San Francisco. 2. No. (a) No; (b) no; (c) don't know. 3. Private. 4. Carts, 2- and 4-wheel, covered. 6. Yes, and weekly. 8. Yes. 9. None. 10. Public dump, lowlands. 11. Yes, and had to be covered. 12. Hired. 13. By burning.

Springfield, Mass., I. Kimbal, secretary of board of health. 1. Carried to city farm; fed to swine in part, balance used as fertilizers. (a) Carried away for fertilizing; (b) dumped on the bank of the river; (c) carried away and worked over for manure; (d) included in garbage; (e) from vaults carried to surrounding farms. 2. Does not. (a) None; (b) for garbage only; (c) for garbage only, $7,000. 3. Public. 4. Covered. 5. Cannot say. 6. Estimated ten tons. 10. City farm. 11. To some extent; mostly the foul air which arises. 12. Hired. 13. That is what we are looking for some one to solve.

St. Joseph, Mo., Logan P. Currin, clerk of board of health. 1. Hauled to Missouri river in closed wagons. (a) Revolving broom, attached to common wagon; (b) thrown into Missouri river; (c) ditto; (d) ditto; (e) ditto. 2. No; owned by private individuals. 3. Private. 4. Closed wagon. 5. Do not know. 8. Yes. 9. Dead stock is rendered by factories. 10. Into river. 12. By health officer; paid by private individuals. 13. No improvements at present.

St. Paul, Minn., Oct. 19, 1891. Report of Henry F. Hoyt, commissioner of health. 1. Merz. (a) Filling vacant lots that are below grade; (b) ditto; (c) ditto; (d) Merz; (e) sewers, which empty into Mississippi river. 2. No; private company,—cannot say. (a) Merz reduction works; (c) city pays $15,000 per annum. 3. Public. 4. One-horse, covered wagon. 5. Cannot say. 6. 20 to 25 tons. 7. One pound per day. 8. Yes. 9. Only garbage containing grease is valuable; sold as fertilizers and grease. 10. In the city limits. 11. None that I consider serious. 12. Hired. 13. By a more thorough education of the masses upon sanitation.

Toledo, O., Albert W. Fisher, health officer. 1. Buried. (a) Collected by the street commissioner and buried; (b) ditto; (c) collected by the street commissioner; (d) removed from city; (e) into the Maumee river. 2. No. (a) For dead animals; (b) 12 horses, 8 wagons; (c) private contractor. 3. Contractor receives $10,000 per year. 4. Closed wagons, water tight, 6. 16 loads. 8. Refuse matter and garbage are placed in boxes and barrels, etc., placed in alley, or convenient to garbage collector. 9. Not used; burned, or ploughed under. 10. Beyond city limits. 11. No. 12. Hired by contractor (men *not reliable*). 13. I favor the city doing this business under the care, direction, and supervision of the H. O. and S. policeman; also favor a crematory. The present system will soon create a nuisance.

Wilmington, Del., W. C. R. Colquhoun, secretary. (a) Collected by contract and hauled to dump; (b) collected by contract; filling up streets; (c) garbage hauled to piggery; (d) ditto; (e) some is run into creek leading into Delaware river. 2. No. (a) No; (b) no; (c) no. 3. Public. 4. In water-tight, square wagons. 6. 75 tons in summer, 6 months; 50 tons, 6 months, winter. 7. Population, estimated 64,000; 31 pounds to each inhabitant per day. 8. Yes. 10. Piggery two miles from the city. 11. Much complaint is made against the contractor's neglecting to collect. 12. Contract. 13. Hard question. Hope you can adopt some plan. I have no suggestion.

Yonkers, N. Y., Valentine Brown, health officer, 1. Used for fertilizing. (a) Used to fill in low ground; (b) ditto; (c) ditto; (d) ditto; (e) into Hudson river. 2. No work done by contract system. (a) No cremation; (c) removing from city proper 12,000. 3. Public expense, 4. 80 covered wagons. 5. Cannot say. 6. 18 yards. 7. At least 19 per day. 9. Not sold. 10. Farms. 11. Yes; from leaking carts, and dumping garbage mixed with ashes; in making new land, etc. 12. Hired. 13. By collecting in water-tight vessels and then cremating.

"E."

THE MERZ OR VIENNA SYSTEM.

By EDWARD CLARK, M. D.,
Buffalo, N. Y.

"The Merz" or "Vienna" system, as it is sometimes called, for the disposal of garbage and refuse, is in use in six or seven cities of the United States. By this method the garbage is not cremated, as has been erroneously supposed by many, but is subjected to a process more nearly akin to desiccation. The garbage and refuse, when first received, is placed in closed retorts or dryers, where it is subjected for some hours to a high temperature, by means of which it is completely dried. This dried residue is afterwards treated by means of a chemical solution which extracts all of the oils therein contained. This, in brief, is the entire process, but a more detailed explanation of the works and the machinery employed will be necessary in order fully to understand just how the work is done.

By means of a runway or elevator, the garbage wagons are taken to the second or receiving-floor of the building, and at once the garbage enters tightly closed receivers, from them it passes down through hermetically closed chutes into what are known as the dryers, which are placed horizontally just below the receiving-floor. These dryers consist of concentric cylinders, one within the other. The inner cylinder receives the garbage and refuse by means of the chutes from the receiver, as above stated, and in its interior is a steel reel provided with innumerable square arms connected on top, which, during the process of drying, is continually revolving in the longitudinal axis of the dryer. The outer cylinder is nothing more nor less than a jacket for the inner one, and is covered with Asbestos for the purpose of retaining the heat. Between the two cylinders is a chamber into which superheated steam is admitted at a temperature of about 300° F. Each dryer holds about three tons of garbage, and after being filled and closed the steam is turned on, and six hours occupied in the drying process. During this interval it is stated that the garbage loses about sixty per cent. of its weight, and becomes thoroughly dry. This large percentage of weight passes off in the form of watery vapor through combination condensers so constructed as to destroy all gases that will yield to water or fire, as well as those requiring both elements for complete destruction, and thence directly into the sewer. The dryers are emptied by means of steam-tight doors in the bottom of the cylinder, and their contents are carried at once by means of conveyors to the extractors.

"The extractors are square upright tanks with a false bottom," in which for a period of six hours the product of the dryers is subjected to the action of a chemical solution, benzine being most generally used, and "by means of which the oily constituents are wholly removed." The benzine is then recovered, and the dry residue is removed from the extractor. Dead animals are treated in separate dryers, which are precisely similar to those used for garbage, except that they have a special connecting pipe for filling. They are treated in the same manner, and subjected to the same process in the dryers as is the garbage.

Prof. Wm. M. Chauvenet, of St. Louis, has given much thought and attention to this matter, and in an exhaustive, able, and impartial report made to the council of that city, under date of December 10, 1890, after being directed by that body to visit and investigate the Merz plants in operation at St. Paul, Milwaukee, Chicago, Detroit, and Buffalo, says of the chemistry of the process,—

"The question as to what takes place in this drying process is perhaps difficult to answer, theoretically, and would demand the most exhaustive chemical analysis to determine. Practically, the results are easy of explanation.

"As long as vegetable organic matter retains its water of composition, it undergoes continual change and decomposition when exposed to the air, during which its malignant gases are set free and given off. The Merz system drives off all water of composition and all moisture in a closed retort, protected from the air and at a high temperature; alters and fixes the decomposable acids, and delivers a product no longer subject to decomposition, even upon long standing.

"The first question asked in regard to the Merz process, even by those who visit the plant, is, What becomes of the gases given off from the dryers during the process of drying garbage?

"After visiting three Merz plants in active operation, and after long discussion of the matter with other chemists, I am of the opinion that there is little or no gas given off in the process of drying, since I do not think the temperature within high enough to decompose vegetable fibre.

"In regard to this temperature there has been some question in my mind throughout. The figure (350° F.) given us at the various plants was not the result of direct measurement in any instance, since this is a difficult question to determine, but since lard oil will begin to smoke and decompose at a temperature of 350° in air, and since no such decomposition of the animal fats in the dryer takes place in any large degree, I think we are safe in concluding that the temperature of 300° F., is nearer the truth. The very dark color of the fatty oil as it comes from the extractor is doubtless due to a slight carbonization or burning, but it must be very slight.

"This conclusion has nothing to do with the sanitary nature of the process, except in so far as it shows that there are probably no burning greases and gases of decomposition to escape from the works; and that, therefore, it is not a surprise that they do not come through the condenser, which I think they would do if generated.

"We have had no time to make the chemical tests which would determine these questions, but, as I have above said, it is of no practical importance under the circumstances. Our investigation must lie wholly with the sanitary nature of the process."

Of the plants in operation in different cities visited, he speaks as follows:

"On approaching the works in St. Paul, no odor was perceptible outside the building, excepting a faint smell of crude petroleum used for running the engines, and which is stored in tanks some distance in the rear of the works. In the delivery-room, where garbage was being unloaded and where several dead horses were being treated at the time, the smell was offensive. In that part of the works devoted to the process of drying and extracting there was no offensive odor whatever, other than a faint smell of benzine.

"The establishment, as a whole, was far less offensive than a soap-factory, and had none of the disgusting features of a rendering-works. After the garbage and animal matter is once in the dryers (and it goes there at once) there is no possibility of offence whatever, even to the most squeamish nostril, and were it not for the pile of garbage, and the animals on the delivery-floor above, the works would be as free from offence as a linseed oil factory. That they are not so is entirely due to the crude way in which the garbage is delivered from carts, out of which it is shovelled upon a floor instead of into hoppers direct.

"The dried residue, before the extraction of the oil, has a faint oily smell; after the extraction, as it lies in the warehouse, it is as inoffensive as garden loam, which it much resembles, and can be handled with impunity, since it is odorless.

"In the St. Paul warehouse was a pile of this product which had been exposed to the air for some five months, which showed no evidence of decomposition, and was as wholly inoffensive as when made.

"The Milwaukee plant has a capacity of forty tons, and is located in the heart of the city. We found this plant treating from thirty-five to fifty tons a day. Outside of the factory there was no offensive smell to indicate what was going on within. The garbage was being delivered in quantity, and in the delivery-room the smells were very offensive. The machinery was running in an orderly manner, and that part of the factory given up to the process proper was inoffensive, and smelled only of benzine.

"There are thirty-nine wagons delivering garbage in Milwaukee, and the shovelling system in use strikes one as slovenly and unclean. The product, which was stored in an open shed, was totally inoffensive after six months' storage.

"The forty-ton plant was not in operation at Chicago.

"In the Detroit plant the delivery-room was open to the same objections as those of the works above described, and the garbage, shovelled from box-wagons upon a wooden floor raised above the street, with its wide doors open to the air, was the cause of much complaint. The condensing engine in this plant was an experiment and a failure, giving rise to a sour smell, due to escaping gases of an acetic nature—a fault not existing at other plants.

"The Buffalo plant was not in operation, and was not visited."

As regards the question of bad odors and nuisance in connection with this method, the report speaks as follows:

"It is my opinion that the odors existing within the works of the various plants were wholly from the freshly delivered garbage lying upon the floor, and had nothing to do with the process of drying and extracting of the Merz process, which is inoffensive from its nature.

"The plants in Chicago, St. Paul, Milwaukee, and Detroit are badly located. It is not surprising that there should be complaints, which there certainly have been, in view of the present methods of delivering the garbage.

"These complaints have in all instances come from those living close to the works, and were due not so much to the process of conversion as to the unclean method of delivery and the congregation of so many garbage-carts in one locality.

"As to the process in the works themselves, we did not hear one complaint throughout our trip."

Prof. Chauvenet concludes his report of investigation and study of the Merz system as follows:

"In reviewing, then, the many interviews and debates in regard to the Merz system, continuing through many days, I find the representatives of the several communities in which the Merz plants have been in operation universally in favor of its introduction. My own investigation, both sanitary and chemical, leads me to the following conclusions:

"1st. That the Merz system, from a chemical stand-point, is an ingenious and perfectly rational process.

"2nd. That it is a perfectly inoffensive and sanitary process for the conversion of offensive animal and vegetable refuse into an odorless and inoffensive product.

"3rd. That the complaints against the system are wholly due to the method of handling and delivering the garbage, for which the Merz system is in no way responsible.

"4th. That with proper methods of collection, proper steel dump-wagons, and properly arranged hoppers for the reception of the refuse, the Merz system will be perfectly free from objectionable features.

"We are told that at Paterson, N. J., the improvements in delivery and the arrangement of hoppers are complete."

The report from which the above quotations are taken was made to the council of St. Louis under date of December 10, 1890.

"F."

THE RIDER GARBAGE FURNACE.

By CROSBY GRAY,
Chief Clerk Department of Public Safety,
Pittsburgh, Pa.

Before entering upon a description of the furnace, a brief reference to the conditions and events which led to its adoption in this city may not be out of place.

In common with most other communities, Pittsburgh has long wrestled with that all important question, "How can the garbage and refuse be best disposed of?" The sanitary authorities, of course being most directly interested in the subject, gave it the greatest amount of attention, and devoted many anxious hours to its consideration. Several projects were formulated, which were intended and expected to solve the question, but each in turn failed on account of the lack of moral and financial support expected from the legislative branch of the city government and from the public.

The question of the proper collection and removal of this material seemed to be a simple problem under the law, provided the necessary funds were available, but

even this was found to be wanting. The most important and decidedly knotty phase of the subject, however, was,—given the funds and appliances necessary to the collection, where, and in what manner, could it and must it finally be disposed of?

The peculiar topography and surroundings of the city of Pittsburgh made this a question of unusual consequence. The city itself being composed of a succession of hills and valleys, and surrounded on almost all sides by hills, made the transportation of such material out of the city, by the ordinary methods, much more expensive than in many, if not most other, localities. Carriage by water was considered as being almost out of the question, on account of the variable stage of water in the rivers, and their being often closed by ice during the winter season.

In 1881 the board of health concluded to make a supreme effort to accomplish the end in view, and advertised for proposals for the collection and removal of ashes and garbage, as authorized under the provisions of an act of assembly, passed in 1872, as follows:

"SEC. 33. The board of health[1] are hereby authorized to employ, from time to time, as many scavengers as they may deem necessary, upon such terms and with such appliances and conveyances as they may deem expedient; and to make, from time to time, such rules and regulations for the conduct of such scavengers as they may deem necessary."

Very complete and elaborate specifications were prepared, which provided for the collection and removal of garbage from residences, hotels, restaurants, etc., daily during the months of June, July, August, and September; three times per week during the months of April, May, October, and November; and twice per week during December, January, February, and March. Ashes were to be collected once per week during the months of May, June, July, August, and September, and twice per week during October, November, December, January, February, March, and April. Ashes and garbage were to be kept separate, in water-tight vessels not larger than a half barrel. Garbage was to be removed to a point or points outside the city limits, and disposed of in such manner as might be decided upon by the contractors. Ashes were to be used for the filling of streets, sunken lots, etc., as might be designated from time to time by the proper city authorities.

Proposals were received in response to said advertisement, and the contract awarded to the lowest bidder for the sum of $24,379 per annum. Unfortunately city councils refused to make the necessary appropriation for carrying out the contract, in consequence of which it was declared null and void.

The subject still continued to agitate the minds of the sanitary authorities, in proportion as the necessities of the case grew; which growth was commensurate with the rapid increase of population.

Not until the early part of 1887, however, did any method present itself which appeared likely to bring the coveted relief. The discovery of "natural gas" in this vicinity, and its adaptability as a good and cheap fuel, induced the authorities to view it as a possibly valuable factor in solving the garbage problem. This was further induced by the favorable experiments made on this line by the city of Wheeling, West Virginia.

[1]Under the provisions of the "New Charter" of the city of Pittsburgh, which went into effect on February 1, 1888, the board of health was abolished, and all its power and authority vested in, and transferred to, the department of public safety and bureau of health.

At a meeting of the board of health, held January 7, 1887, the following resolution, passed in councils December 27, 1886, was received:

"*Resolved*, That the board of health be, and they hereby are, requested to report to councils a method of removing refuse and garbage from the city, on account of the difficulty arising from the burning of said material in stoves and ranges in which 'natural gas' is used as fuel."

In response to the above request, the board prepared, and submitted to councils at their next meeting, the following reply:

"*To the select and common councils of the city of Pittsburgh:*

Gentlemen: In response to your resolution of December 27, the board of health respectfully report that, after careful consideration of the subject, they are of the opinion that the most economical and satisfactory method of disposal of garbage and butcher's offal is its destruction by fire. This, in our opinion, can best be accomplished by the construction of furnaces for that purpose in different parts of the city, and by using natural gas as a fuel. When this has been done, the persons engaged in the business of removing said material from dwellings, etc., should be required to do so under certain restrictions,—among others, that it be deposited in said furnaces.

"We are of the opinion that suitable plants can be erected at a cost ranging from $1,600 to $2,000 each.

"For the purpose of carrying said project into effect, we would respectfully ask your honorable bodies to make a special appropriation of $7,000, a portion of the same to be expended in the erection of one or two experimental furnaces, which, if they prove successful, should be supplemented by others out of the balance remaining in said appropriation.

Respectfully submitted,

J. C. DUNN, *President.*

J. D. THOMAS, *Secretary.*"

In compliance with the foregoing request, city councils did make a special appropriation of the amount mentioned, for the erection of experimental plants.

After further investigations had been made, the board of health, at a meeting held on March 25, authorized and directed the health officer to advertise for proposals for the erection of two "garbage furnaces," in accordance with the requirements of the following general specifications, viz.:

"1. Said furnaces to be erected in such locations in the city of Pittsburgh as may hereafter be designated by the board of health of said city.

"2. Said furnaces to be constructed of such a size and capacity, and upon such a plan, as to fully and completely consume, without any offensive odor arising therefrom during the process of combustion or at any other time, not less than thirty (30) tons each of either garbage, night-soil, or butcher's offal, every twenty-four (24) hours.

"3. Said furnaces to be constructed so that horses and wagons can be conveniently and safely driven upon or over the top, and said wagons unloaded directly into said furnaces; and so that at least four (4) of said wagons can be unloaded at one and the same time.

"4. Said furnaces to be built of first-class material, and in a good and workmanlike manner; and all labor and material used, and all other outlay whatsoever, to be furnished by, and at the sole cost and expense of, the person or persons contracting with the board of health for their erection.

"5. If, upon a thorough and complete trial or test of said furnaces, they do not

fully meet the requirements, as specified and agreed upon by the said board and the person or persons contracting to erect the same, of which requirements the said board shall be the sole judge, then neither the board of health nor the city of Pittsburgh is to be held liable for the cost of said furnaces, or any part thereof.

"6. Full and complete plans, drawings, and specifications of said furnaces shall accompany each and every proposal for their erection, the same to be furnished without cost or expense to the said board of health or the city of Pittsburgh.

"7. The board of health reserves the right to reject any or all bids."

In response to said advertisement several proposals were received, and, after careful consideration, a contract was entered into with the "Rider Garbage Furnace Company, Limited," of Pittsburgh, for the erection of one experimental furnace, at a cost of $3,000, to be located at such point as might be designated by city councils or the board of health.

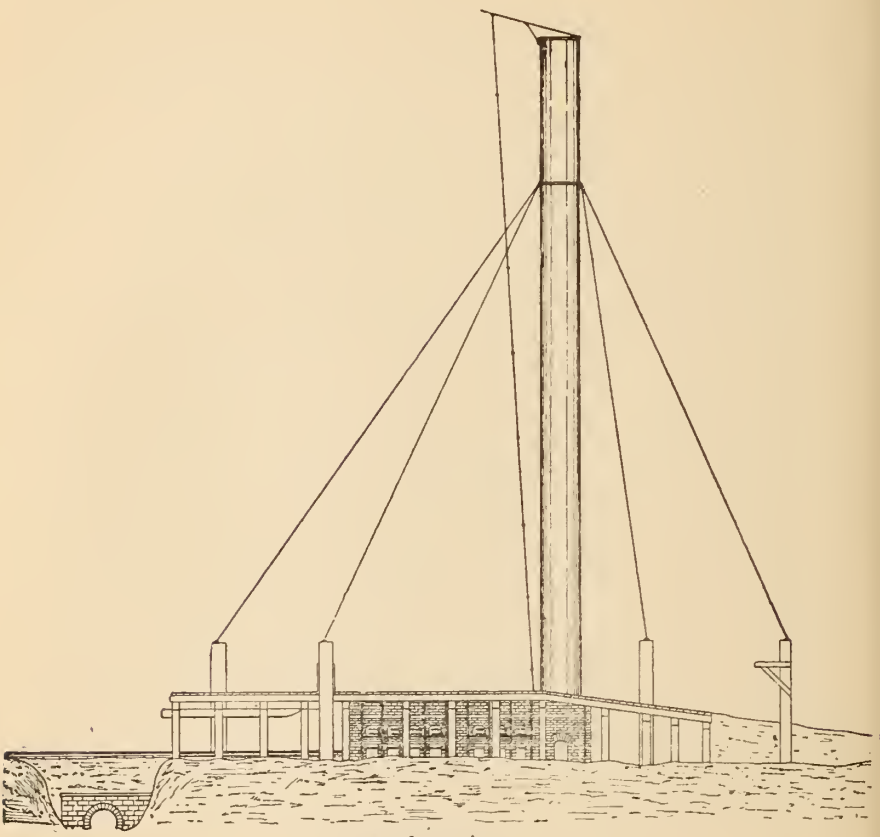
Numerous delays, caused by the difficulties incident to securing a proper site, etc., prevented the completion of the furnace until very late in the following autumn.

When completed, a number of tests were made, coal being used as fuel, most of which proved to be successful. The tests made in the consumption of garbage were especially so. But one test was made with night-soil, and that only a partial one, on account of the violent opposition of the few residents of the locality to the carriage of the material through their neighborhood, but enough was developed to determine that such material could be destroyed, with probably a few changes in matter of detail. The tests made with butcher's offal were also satisfactory. Owing to the peculiar conformity of the ground upon which it was erected (a steep hillside) the third specification was so modified as to permit, or require, the unloading of but two wagons at the same time, and they only from one side of the furnace. The supply of garbage being so variable, it became necessary to provide a receptacle or tank at one side of the furnace into which the material should be dumped from the wagons. This was constructed of boiler-iron, with a perforated bottom through which much of the fluid matter was conveyed into a sewer by means of pipes or spouts. A shed was also constructed, in order to protect the furnace and employés from the weather. The cost of these two items or additions to the plant, and not provided for in the general specifications, was divided between the city and the contractors, the city's share aggregating $750, thus making the total cost $3,750.

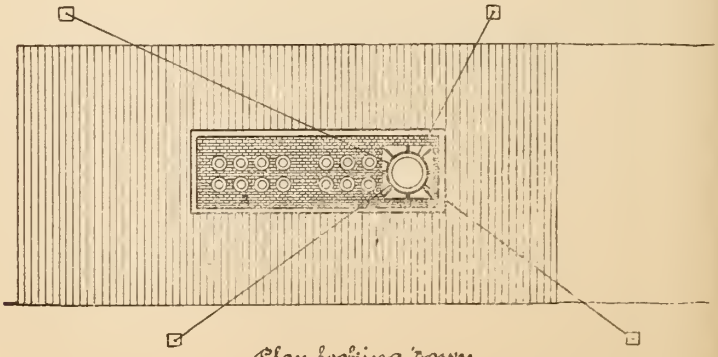
In construction it is an elongated furnace of two chambers, separated by a bridge wall of fire brick three feet in thickness, and having in its upper portion a semi-circular opening to admit draft from chimney and to allow the flame from the front or combustion-chamber to pass freely over the contents, and to heat to an intense degree the roof of the dome, from which heat is radiated to the contents below.

In the dome, or top of the furnace, there are fourteen circular openings, eight in the first chamber and six in the second. These openings are sixteen inches in diameter, and three feet apart on centres, except at the fire wall, which intersects the furnace latitudinally and separates openings at that point by about six feet. The front chamber is about twelve feet long by six and a half feet wide; rear chamber, about ten feet by six and a half feet. The smoke-stack, which rises at

Rider Garbage Furnace
Capacity 30 Tons in 24 Hours



Side Elevation



Plan looking down

end of rear chamber, is eighty feet in height, made from iron plate bolted or riveted in the ordinary way, lined to the top with fire brick four inches in thickness, and has a diameter of four feet in the clear.

The base of the furnace in the front chamber is composed of grate bars set in the fire brick, and in the second chamber, beyond the fire wall, of solid brick.

The first two openings in the front chamber are used for receiving the fuel necessary to properly heat the furnace, supplemented by a small amount, in the shape of wood, used in the second chamber. Before beginning to feed the furnace with garbage it is thus heated to a very high degree.

The foundations of the furnace and stack are built of rubble masonry (laid in lime mortar) 3 feet 6 inches high. The side walls are 24 inches thick; footing course, 8 inches high and 3 feet wide; foundation, under bridge wall, 3 feet thick; under stack, 7 feet 6 inches by 10 feet 6 inches on top, and 8 feet 6 inches by 11 feet 6 inches at base.

All masonry above the floor-level is built of red and fire brick to the dimensions required, the red brick being laid in lime mortar and the fire brick in fire clay. The end and side walls on inside of furnace, from 10 inches below top surface of grate bars and floor of reducing-chamber, also the full depth of jambs and arches of openings, are of fire brick 4½ inches thick. The bridge wall between grate, furnace, and reducing-chamber, also between-reducing chamber and stack, is of fire brick from 10 inches below top of grate bars. The arched roof of furnace is of fire brick, and 9 inches thick. The top of furnace, bottom of reducing-chamber, and ash pit are paved with fire brick laid on edge. Bottom of reducing-chamber is 9 inches thick. The charging-holes through roof are lined at top with cast-iron rings having movable cast-iron covers, which, when in place, are flush with top of furnace. The doors and frames in side walls of furnace and reducing-chamber above the line of grate bars are of cast-iron; frames are set in sill plates, said sill plates being on a level with the top surface of grate bars and projecting 3 inches inside, and to a width equal to the height of rib on buckstave on the outside of furnace. The door frames are held in place by the buckstaves. Each frame has doors swung on hinges, and lined on inside with liners of fire-clay.

The ash-pit openings under grate bars in the side walls are covered on top with cast-iron plates, the full width of wall. The ash-pit doors are of wrought-iron, and have wrought-iron handles. The top edge of side walls and of end wall are protected by a cast-iron plate. The furnace is harnessed with wrought-iron rods and cast-iron buckstaves and plates.

The stack is 80 feet high above top of furnace. The cylindrical part is 75 feet high, and 4 feet 10 inches outside diameter. The base is 5 feet high, and the wrought-iron stack rests on a plate 1¼ inches thick, which is provided with a circular ring for holding same on base where it rests on top of furnace. The stack is lined with fire brick 4½ inches thick, and is stiffened with four 1½- by 2-inch angle irons riveted vertically on inside, and equal distances apart. A 2½- by ½-inch wrought-iron ring is riveted on the outside of top. The stack is held in place by four guy-rods connected about twenty-five feet from the top.

It has been in continuous use since April, 1888, except on two occasions when it became necessary to close it for repairs, principally caused by defective workmanship in its original construction.

During the year 1889, the only one in which an accurate estimate was made of

the work performed by the furnace, there was consumed 23,460 cubic yards, or 9,384 tons, making an average of 75 cubic yards or 30 tons per day, at an operating cost of 35.9 cents per yard, or 89.9 cents per ton.

This work was done without offence to either sight or smell, neither odor nor smoke arising from the process of combustion being perceptible. During the busy season it is operated both day and night; six men are employed in its operation, and natural gas is used as fuel.

In the opinion of the writer, the cost of operating is too great, and could be considerably reduced. The enormous advance in the price of natural gas renders its use as a fuel for this purpose entirely too expensive. Coal, coke, or even slack might be substituted to good advantage. The number of employés could also be reduced, by probably one third, without detriment to the service. The method of feeding or charging the furnace is also faulty. At present the material is drawn from the receiving-tank into galvanized iron vessels holding about a barrel, which are conveyed to the charging-holes and the contents deposited in the furnace. This involves too much handling, and adds materially to the expense.

A better device for the purpose would be the placing of the receiving-tank on top of the furnace, with which it should be connected by means of circular conduits, through which the material could be conveyed directly into the charging-holes, thus reducing the cost of handling very considerably.

A Rider furnace has been in successful operation in the neighboring city of Allegheny during the past three years. I am informed by the superintendent of the bureau of health of that city that the cost of this plant, including buildings, approaches, etc., was $5,700. Its estimated capacity is thirty tons per day. Two men, and a portion of the time three, are employed in its operation. It is in use only during the day-time. I am informed that the cost of operating it is about $150 per month.

"G."

THE ENGLE GARBAGE CREMATOR.

By Col. W. F. MORSE,
New York.

The history of the Engle Garbage Cremator, from the time five years ago when the inventor began his experiment to improve upon the old-fashioned way of disposing of the waste organic matter of his own house, down to the present time when the cremator destroys the waste of large cities, is a history of successive stages of experiment and growth.

From the beginning, the absolute and total destruction of worthless and offensive matter was the purpose proposed, and to do this without creating a more objectionable condition of things was the problem. Step by step the apparatus took on a more improved and simplified form, until his invention, the original night-soil destructor, was adopted at several places for the smaller public institutions, where was shown its utility and value.

Then the need of some larger plant for the use of the whole community became evident, and the first garbage cremator was built at Des Moines. This was fol-

lowed presently by other furnaces, and these in turn by other and larger cremators, until at this time there are nineteen cities and towns using this form of garbage disposal, and others in process of construction.

The leading principle of the Engle device was the burning of the material in such a way as to destroy the fumes or gases of combustion, and utilize these to aid in forming heat for the destruction of the original material, and it was only after repeated efforts and experiments that this was accomplished.

The Engle Garbage Cremator, of whatever size, is a rectangular brick structure with openings on the top for feeding the garbage through, with two fires, one at each end, and a garbage-grate between these sustaining the material to be destroyed in such a way as to cause the smoke and products of the garbage combustion to pass across one or the other of these fires and so destroy the fumes, and use this heated and burning smoke and gas as a fuel.

A cremator of the larger size is 32 feet long, 9 feet wide, and 12 feet high. At one end a brick chimney nine feet square and 75 to 100 feet high, or an iron chimney of 50 to 70 feet on a base of 20 feet.

The top of this furnace has four circular openings, three of 24 inches and one of 34 inches in diameter. There are platforms at the side of these openings allowing a cart to be emptied directly into them, and over all a covering house with sliding doors and iron roof.

Below, on one side and at each end, are two large fire-doors, and along the bottom between these fire-doors are others called ash-pit doors, while above there is a range of smaller round doors through which the garbage is stirred up or stoked.

Half way from the top to the bottom of the interior are set the bars which catch and retain the garbage fed through the circular holes on top. The two fire-boxes at either end inside are on a level with these bars.

Below is a platform or hearth, dished or sloped to the centre, which catches and holds all liquids passed through the feeding-holes and falling through the garbage-bars.

Underneath this again comes a long flue running the whole length of the furnace and going directly into the stack.

There are dampers which control the openings into the chimney and the openings into and out of the combustion-chamber under the bars.

The furnace being charged with garbage, which in this case would be say 15 cubic yards, the fires are lighted, and the flames from the fire nearest the stack, or first fire, pass over and through the garbage, driving the smoke and gases into and across the left hand or second fire, where they are consumed.

The flames from this burning fuel and gas pass down on the left hand or outside this second fire, and are by the action of the draught brought back under the garbage-grate and carried on their way toward the flue into the stack or chimney where discharged.

By an action of this returning fire the liquids received in the shallow pan or depressed hearth under the garbage-grates are evaporated and burned.

By arranging the dampers, the flames from the first fires may be passed across the second fire and under the hearth, insuring the perfect combustion of all vapors from the liquids.

Or, if desired quickly to consume the garbage at a time when the drying action

of the first fire has expelled the gases and moisture, then the dampers are so operated as to pass the flames directly into the chimney, but in no case can the smoke or fumes escape without passing across one or the other of these fires.

The ashes as they fall through the garbage-bars are raked out through the lower range of doors, and from time to time, as needed, the garbage is stirred up and distributed over the garbage-grates through the upper range of stoke doors,

The action of the furnace is continuous. The garbage is fed in as needed, with no material loss of heat or escape of flame; the closing of the doors before this is done creates a strong down draught through the feeding-holes. The larger feed-hole receives the body of a horse, though a portion only of this opening is used in usual service.

The garbage-grates being made of pipes, with a circulation of water, there is always steam and hot water for cleansing and disinfecting the pails, barrels, and carts used in the collection service, and for keeping the platforms and surroundings clean.

If desired, there may be a steam boiler for obtaining power attached, so as to be heated by the flames from the furnace.

The construction of the cremator is of the most solid and massive character. To withstand the intense heat required to burn matters containing large amounts of moisture—to burn, in many cases, water itself—to maintain this temperature for weeks or months together without a stop, and to remove the products of combustion with no interference with the work of the furnace, demands a structure which shall be durable, effective, and convenient.

The walls are lined with fire-clay blocks, 12 by 9 by 8 inches, laid close as possible, and backed by a double brick wall. All the openings are protected by solid fire-clay blocks shaped to fit the apertures, no iron except the surface of the garbage-bars being exposed. These blocks are specially made of the most refractory material to be had, and shaped and cast so that they fit accurately together. Outside, the braces, thrust bars, buckstays, and tie-rods hold every part firmly, while the fire-doors are carried on heavy iron panels similar to boiler fronts, the utmost care being taken to make every part as strong as the best brick and iron can be put together.

The capacity of the Engle Cremators, and their consequent cost, have been approximately determined by establishing four sizes adapted to an equivalent number of people, viz.:

No. 1, the smallest public furnace, may be said to be adapted to a town of 2,000 to 3,000 people; No. 2, 3,000 to 5,000; No. 3, 6,000 to 10,000; No. 4, 12,000 to 25,000. It is impossible to give exact figures in this connection, as much depends upon the character and kind of refuse, the amount of liquids, the kind of fuel, and the varying conditions; and for the same reasons it is impossible, in the absence of exact information, to quote exact estimates of cost and maintenance, but an approximation can be arrived at.

A cremator of the largest size will destroy an average of seventy-five cubic yards of the daily miscellaneous garbage and refuse of a city, and may, when occasion requires, consume a much greater amount. The largest quantity destroyed in one day in one furnace of the size No. 4, was 145 cubic yards of garbage and refuse, and the body of a horse.

For cities of the largest size a number of cremators at different points are

required,—or, as is sometimes done, two or more burning garbage and night-soil separately are built together, using one chimney, economizing space and expenses of labor.

The cost of maintenance, or running expenses, depends mainly upon the cost and kind of fuel used. Wood, coal, gas, or oil may be used, as is most convenient. The records kept of the quantity of refuse destroyed at various places and the cost of same, give a basis for calculation for use elsewhere.

To destroy seventy-five yards of the ordinary garbage collection of a city will require the labor of three men and the combustion of one to one and a half to two tons of coal, or its equivalent in wood or other fuel. With coal at $2 per ton, the cost per cubic yard for fuel and labor will be about 10 cents, and proportionally higher as the cost of fuel increases. With natural gas the cost falls to 8 cents or even less.

The destruction of night-soil is accomplished by the Engle Cremators. Where the quantities are great, a specially built furnace is best, but where small amounts (from 10 to 30 barrels per day) are involved, it is burned in the same furnace after the combustion of the garbage. The cost of destroying a barrel of night-soil containing from 15 to 45 per cent. of liquid is about the same as for one cubic yard of garbage.

The bodies of animals of whatever size are burned with no interference with the regular work of the cremator. Refuse paper, manufacturing scraps, house-, store-, and shop-sweepings, small fruit cans and meat tins—every worthless and useless combustible waste which fire will affect—are classed as a part of the inorganic waste of a city, and consumed in this furnace. The destruction by this furnace of articles which have been in contact with infectious or contagious diseases, bedding, clothing, furniture, etc., as well as all kinds of hospital waste, without the chance for escape of disease germs, is a means of great service to health officials in stamping out contagious diseases.

The ashes of combustion of garbage (animal and vegetable matters) have a positive value as a fertilizer. While chemical analysis shows the presence of potash and phosphoric acid amounting to 7 to 12 per cent., the practical results of the use of this fertilizer in the hands of farmers is a far more satisfactory test, and has been uniformly successful. There is also a large amount of débris, coarse ashes, tins, iron, crockery, etc., of value for filling low grounds or as foundation for streets.

The cost of construction of these furnaces can only be approximately stated, as without personal investigation there are many conditions which cannot be accurately estimated. But the expense of constructing an Engle Cremator of the smallest size (No. 1), with covering house, platforms, and approaches, completed and in working order, may be stated at $2,500 to $3,000. The larger sizes increase proportionately in price, depending upon location, expense of labor, material, and other considerations.

The Engle Garbage Cremators have been in continuous use at seventeen places since their establishment, where have been constructed twenty-six furnaces of the various sizes.

One of the smallest size is in use for the destruction of infected articles and hospital waste; two of the next size (No. 2) are at U. S. government posts; fourteen of the size No. 3 have been built, three of which were afterwards

replaced by larger ones; and nine of the largest dimensions (No. 4) are now in constant operation.

Four cities erected at the beginning each two furnaces, for garbage and night-soil respectively; and at nine places both night-soil and garbage are destroyed by the same Engle cremator.

"H."

GARBAGE DISPOSAL IN EUROPE.

By RUDOLPH HERING, C. E.,
New York.

As a small contribution to the work of the committee, I append herewith a description of some garbage disposal works which I recently examined at Southampton, England, which are considered not only quite satisfactory, but also economical, in their operation.

I also append a description of the interesting Chelsea works, near London, England, which is copied from the *Engineering Record* of September 19. This description has been prepared from reports made by Sir Douglas Galton, G. R. W. Wheeler, Dr. P. Norman Evans, and others,—the names hardly needing an introduction to American sanitarians.

(a) CHELSEA.

From *Engineering Record*, September 19, 1891.

"The works of the company are at Salopion Wharf, Chelsea, and dispose of a large portion of the refuse of Kensington and Westminster. They have been in operation about two years, and now have a capacity of 35 loads a day. The aim of the inventors of the process, J. C. Stanley and Joseph Russell, has been to utilize every part of the refuse of houses that is of value; and in order to accomplish their purpose the rubbish has to be sorted. This is expensive when done by hand, as is usual in this country, but the Refuse Disposal Co. have adopted a mechanical screening which is reported to be cheap and effectual.

"The dust-carts deliver their loads into a revolving cylinder 10 feet in diameter and 12 feet long. This cylinder is made of iron ribs placed 10 inches apart, upon which are fixed wooden bars, with a clear space of 2½ inches between them, so that anything less than 10 x 2½ inches in size will pass through. The wooden bars are used to keep the bottles that are in the refuse from being broken. The cylinder rests on friction wheels, and is driven by external gearing. Its axis has a tilt of about nine inches in its length. A worm revolves inside the cylinder and works the refuse along, from two and a half to three minutes being required to pass from the hopper to the outfall.

"The material which does not drop through the meshes of the cylinder is taken out and sorted by hand as it arrives at the farther end. It consists mainly of cardboard, bottles, coal, tin boxes, cloth, and animal and vegetable refuse. The last portion is taken to a mill and ground; the remainder is sorted into separate baskets. The screenings from the first cylinder pass into a second 8 feet in

diameter, 16 feet long, and covered with wire-work having 1¼-inch mesh. This cylinder is also supported on friction wheels, is driven by external gearing, and is provided with a central worm to drive along the bodies which do not pass through the meshes.

"The matter that falls from the end of the second cylinder is exposed to a powerful blast of air, which blows the paper from the heavier material into an iron box, where it is subjected to heat from exhaust steam, which is passed through pipes in the chest. The heavier material is raised by an elevator to a slide, placed at such an angle as to regulate its descent to a horizontal iron table, which constantly revolves, and thus passes the material before a number of boys who sort it out. Coal, metals, and boots and shoes are saved, while the nondescript refuse, such as bread, vegetable and animal matter, broken crockery, and the like, is taken to the mill and ground up with the similar refuse from the first cylinder.

"The material which drops through the second cylinder is delivered by an endless band into a third cylinder, also of iron, 6 feet in diameter, 15 feet long, and covered with a wire screen of ⅜-inch and ½-inch mesh. This cylinder is also furnished with a worm. Whatever passes through the former mesh is called breeze, and that which passes through the latter, ashes. The ashes are used to mix with clay for brickmaking, and the breeze is either burnt or pressed into briquettes. Both ashes and breeze pass over a fine shaking screen, which takes out everything below ⅛-inch in size. This is said to be valuable as manure, as it contains the greater part of the animal and vegetable matter ground up in the mill.

"The dust which arises during the operation of the cylinders is removed by a powerful exhaust acting through apertures in the centre of the cylinders, and in other places where the movement of the material generates it. The exhaust carries this light matter into the closed ash pit of a locomotive boiler, of which there are three in the works, all worked by forced draught. The smoke from these boilers, as well as from two others in which the refuse straw is burnt, is driven by an exhaust fan through scrubbers, where it is well washed before passing into the air.

"The paper screenings, after being dried at a high temperature, which can be made high enough to remove any danger of infection if necessary, are sorted and freed from dust, and then pulped for conversion on the premises into brown paper or cardboard.

"A series of experiments made by Bryan Donkin & Co., of London, with screened fuel from the disposal works, gave the following evaporative efficiencies of the different classes of material: Refuse through ⅜-inch mesh, 2½ pounds of water per pound of fuel; refuse through ½-inch mesh, 2¾ pounds; briquettes, 3⅘ pounds; coarse breeze, 3¼ pounds. The proportion of incombustible matter was found to be very high, varying from 31 to 36 per cent. According to Dr. Evans, the company manufactures about 15 cwt. of brown paper from refuse per day of 12 hours. He also states that with more space and better sorting and treatment of the materials the value of the output could be considerably increased. As it is, refuse worth from $2.50 to $5 a ton is made into a paper, selling, it is claimed, at from $35 to $40 per ton. The special value of the process is, however, that it enables the paper to be cleaned immediately, instead of being retained until a market can be found for it.

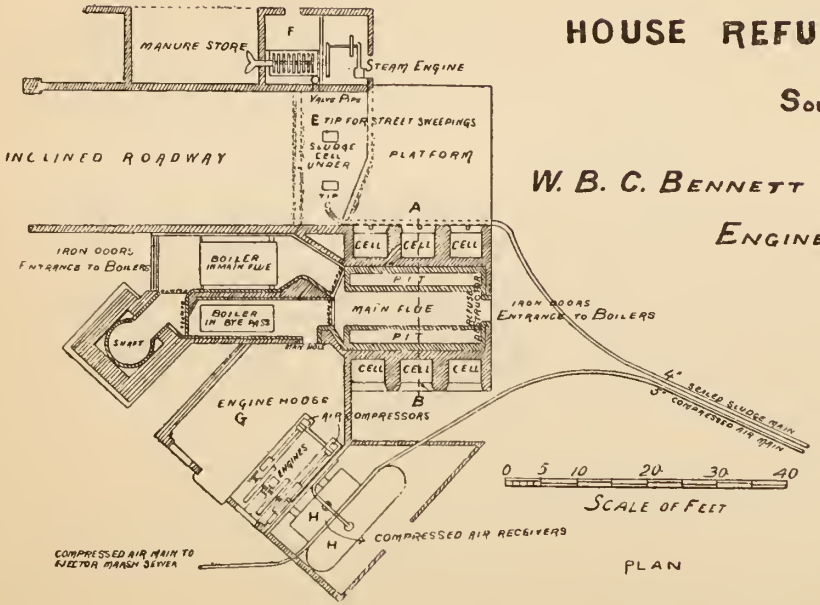
"The great advantage of this method of disposal would seem to lie in the fact

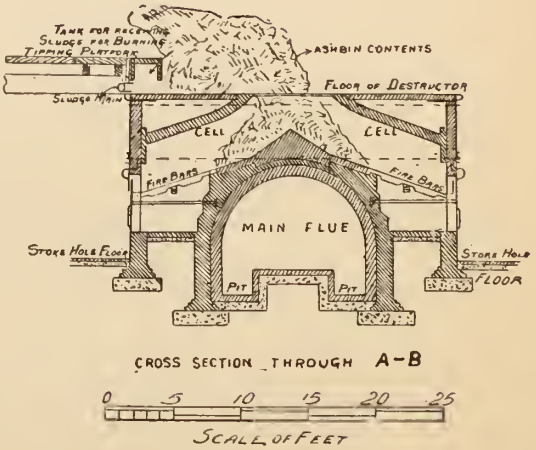
HOUSE REFUSE DISPOSAL WORKS.

SOUTHAMPTON ENG.

W. B. C. BENNETT

ENGINEER





CROSS SECTION THROUGH A-B

that it apparently enables a municipality to realize something on its refuse matter instead of heaping it on dumps to become offensive to both eyes and nostrils, or of burning it in crematories at an expense that has been stated by Prof. Baumeister to range from 20 to 37 cents per ton, including interest on the plant."

(*b*) SOUTHAMPTON.

Mr. W. B. G. Bennett, borough engineer of Southampton, was instructed in 1885 by the corporation to devise a scheme for collecting and disposing of the house refuse of the whole town. After studying the available methods, he built works which may be described as follows: The works have been in use for four years. About sixty car-loads of garbage and ashbin contents are daily collected and disposed of. The carts are especially constructed for the purpose. They are of iron, covered, and discharge their contents directly into the cells of the destructor.

The destructor has six cells or furnaces, each capable of burning 8 to 9 tons of garbage per day. They are shaped and arranged as shown on the accompanying sketch. The garbage and ashbin contents are dumped into a feed-hole, and thence pass by gravity into the cells. The material is dried and heated from the main flue, pouring under the feed-hole, and is finally burnt when by its own weight it reaches the fire bars. It is stated that no coal is used in the works, and that the refuse matter, when dried, furnishes sufficient fuel to maintain the process perpetually. The draft is downwards into the main flue, in which are two boilers, for alternate use as shown, built between the destructor and the shaft, which is 160 feet high. One boiler has 30 H. P., and is multi-tubular and made of steel. In a by-pass, a smaller boiler is situated, to be used when the larger one is cleaned. No obnoxious fumes from the combustion are perceived. The steam generated in the boiler drives a pair of engines which compress air into two large receivers, whence it supplies the power for several sewage-pumps. The steam also serves for drawing precipitated sludge through a 4-inch pipe from the sewage-works to the disposal station a mile distant, where it is mixed with the street-sweepings and sold as manure. Sufficient steam is still left to drive machinery for the preparation of horse-fodder at the corporation stables, and an electric light plant to illuminate the station with its stables and dwellings. It is found that 25 tons of refuse, when burnt, generate sufficient steam for all of the above purposes for one day.

The residue from the continuous day and night combustion consists of about 20 per cent. of good, hard clinkers and sharp, fine ashes; the cinders are used for the foundation of roadways and for the manufacture of paving slabs, which are sold at 2s. 6d., or 5s. per square yard when 2½ or 5 inches thick respectively.

The initial cost of the destructor, including engine-house, inclined roadway, chimney shaft, and boiler, was £ 3,723, or $18,600. The annual cost of burning the refuse is £ 221, or $1,100. The amount burnt is from 25 to 50 tons per day of 24 hours, or costing at the rate of 14 to 7 cents per ton respectively. Against this cost should be placed the profitable use of the steam for power purposes and for lighting.

XVI.

THE PRESENT POSITION OF THE MILK-SUPPLY PROBLEM FROM THE PUBLIC HEALTH STAND-POINT, AND SOME PRACTICAL METHODS FOR SECURING SAFE PUBLIC SUPPLIES.

By PETER H. BRYCE, M. A., M. D.,

Secretary Provincial Board of Health of Ontario,

Toronto, Ont.

Gentlemen: During the interval since our last meeting I have been requested to introduce for discussion a paper on "Public Milk-Supplies." In order to properly lay before the Association a subject so broad in its practical bearings and so replete with important and interesting details, a paper greatly extending the limits of time allowed for any single subject would be necessary. I shall therefore deal briefly with the first part of my subject, in order that I may discuss at greater length those numerous details with which every executive officer of health ought to be familiar.

1. *The Use of Milk as a Food.*—Perhaps nothing will better indicate the importance of guarding this source of food-supply, than to recall the enormous consumption of what from earliest times has been more or less universally used as food by all nations. It is the natural food of all young mammals, whether human-mammal or beast-mammal. "Milk, from the earliest times," says Dr. Wynter Blythe, "even when its composition was most imperfectly known, has been considered the type of foods." Statistics may be given to illustrate the extent of the use of milk and milk-products.

In the Province of Ontario, 737 cheese factories were reported in operation in 1888. Calculating from returns made by 557 factories, the following table is given:

No. of factories.	Milk used, lbs.	Cheese made, lbs.	Value.
737	686,369,013	65,299,751	$6,031,470

In 404 factories, with complete returns, the amount of milk used was 402,599,463 lbs. from 150,618 cows. The average number of days in which the factories worked was 155, and the average amount of milk per cow was 2,673 lbs. The total number of patrons was 24,644, or about one-eightieth part of the population of the province.

Assuming that two thirds of the population of Ontario is agricultural, we may say that but one tenth of the total production of milk in the province

for 155 days, or less than half a year, was utilized for cheese-making. Now, if we multiply the quantity of milk by ten, and added a half for the number of months remaining, we should have the enormous total of over 10,000,000,000 lbs. of milk produced during a single year, or fifteen lbs. *per capita per diem.*

Remembering that the great bulk of the cheese-products are exported, and that butter and milk are the chief foods used in Ontario, it is quite probable that this statistic is not greatly over-estimated.

The report of the Ontario Bureau of Industries for 1890, states that there were in the province that year only 175,000 farmers, having 777,838 milch cows. We have, however, to add to these the many thousands of cows which are kept for purely milk-supply purposes by people in the cities, towns, and villages.

From statistics, I find that in 1890 the number of cows in the United States is given as 15,952,883, each yielding, on an average, 450 gallons per year, or a total of 6,750,000,000 gals.; and that only 5 per cent. of this total is used as butter and cheese, the balance, 95 per cent., being used as milk in its natural state. If all were sold at 12 cts. per gal., it would amount to $810,000,000. In New York state there are 1,552,373 cows.

If, then, this single food-product, having a value so enormous, and in itself a perfect food, is to be continued as a universal food, it is apparent that this Association cannot engage itself with any single subject with such potentialities for good as this food of the nation; or such possibilities for evil, if we admit that it may possess, or become, the medium for disseminating ills, perchance as numerous as those from Pandora's box.

When we think that in the United States there is one milch cow to every four inhabitants, and that one hundred gallons *per capita* is the amount of milk produced annually, we have some idea, not only of the magnitude of interests involved and of the use of milk and milk-products, but also of the enormous task involved in maintaining these 15,000,000 milch cows in good health, and in protecting the milk, when produced, against pollution. There are in the United States 42,000 (graduated in ten years) physicians, whose duty I assume to be to maintain the people in good health or to heal those who are sick. What number of veterinary physicians is there, I ask, who are devoting their attention to the problem of maintaining these milk-producing animals in health, or in preventing evil results from attending the use of milk, unwholesome at the time of taking from the cow, or in its often strange and eventful history up to the time it reaches the consumer?

When we refer to the infectious diseases alone, which affect the bovine species, we see that they are of a number and character such as to urgently demand close attention and systematic supervision. Thus, they are subject to cancer, tuberculosis (in its several forms of scrofula, phthisis pulmonalis, tabes, tubercular meningitis, glandular tumors, etc.), actinomycosis, anthrax, symptomatic charbon (or black quarter), milk-sickness

or "trembles," rinderpest or cattle plague, Texas cattle fever, vaccinia, scarlatina, parturient septicaemia, pyaemia, septicaemia, septic mammitis, glanders, diphtheria and croup, rabies, trichina, taenia, echinococcus, pleuro-pneumonia, eczema contagiosa (foot and mouth disease), etc.

In this extended list I have selected diseases, every one of which has been probably known to this continent, and some of them, unfortunately, too well known. As a rule, it is not those *maladies fulminantes*, slaying whole herds in a few weeks, that cause us alarm in the matter of milk-supply, but rather those less acute diseases, which, owing partly to ignorance, partly to carelessness, and not infrequently to culpable cupidity, and while not depriving a cow wholly of her milk-producing ability are disseminated in milk-supplies, to an extent proportionate to the numerous opportunities offered and to the vulnerability of the person taking the milk.

The past has legends enough of disease spreading to man, which, with greater care, to-day are not so commonly seen; but we are not wanting in illustrative cases. Thus, during the past summer anthrax appeared in an Ontario county in cattle feeding on bottom lands along a creek below a tannery where South American hides are used. Several animals had died suddenly, from what was supposed to be chemical poisoning due to the polluted water from the tannery. The matter being brought to my notice, I investigated, and suspected anthrax, which was verified in my laboratory. In the meantime another cow sickened. She was milked in the evening, and some one luckily suggested the advisability of not using the milk. It was given to some young pigs. Two died within four days thereafter; the majority recovering, as frequently takes place in pigs, Thus, in England and Wales, out of 210 pigs attacked with anthrax in 1890, 117, or over 55 per cent., recovered.

In this outbreak just referred to, a man who, after being warned regarding the nature of the disease, skinned another cow which had died, intending to surreptitiously dispose of the skin, became inoculated, and lay for some time in a dangerous state.

Of those diseases, however, which, owing to their less acute character, we have most difficulty both in detecting and eradicating, actinomycosis is taking a place prominent in the degree that its nature and prevalence are being recognized. On a single day four head of cattle infected with this disease were received into the Toronto cattle-market, and the disease has by statute this year been placed amongst those scheduled as unfit for human food. Some of the dangers of its spreading, and of the difficulties in dealing with it, are admirably set forth in the Annual Report for 1890 of the Health Officer for Chicago.

But, as compared with other diseases, the one which must be recognized on every hand as being, *par excellence*, that to which sanitarians, medical health officers, and physicians must devote their special attention, is tuberculosis. That tuberculosis causes one seventh of all the deaths of the human race is stated by reliable statisticians; that it prevails in

almost every land is well known; that it is disseminated everywhere on the American continent is equally well established; and that it has greatly increased in prevalence is unfortunately too true. That until recent years it prevailed but little amongst American cattle is probable; but that it has increased, as animals improved by in-and-in-breeding have been imported for stock purposes, is well known; and that it has been rapidly developed by the growth of dairying for the supply of milk to the enormously increased populations of our American cities has now become a well authenticated fact. These facts are sufficient to cause us to pay some special attention to the more prominent points of interest associated with the disease in milch cows.

In 1890, of all the cattle slaughtered in Berlin, 4.5 per cent. were tuberculous; while in Upper Silesia, 9.5 per cent. of all slaughtered in a single abattoir were tuberculous. Bitter affirms that, while statistics are not extant, there are, he has reason to believe, at least 10 per cent. of dairy cattle tuberculous in cities and their environs. No precise statistics have anywhere been tabulated regarding the prevalence of tuberculosis in dairy cattle in British cities, but that it is much too prevalent may be gathered from evidence such as that published by the Local Government Board's report regarding tuberculous meat in Glasgow. The reason for the absence of such reports is that tuberculosis is not included in the list of contagious diseases in the (Animals) Contagious Diseases Acts of England and Wales, and animals affected with it can only be got at by the by-laws regarding unwholesome meat and milk. In the report of the Veterinary Department of the English Board of Agriculture for 1890, the following occurs in a paragraph referring to tuberculosis being placed on the list of contagious diseases in animals: "Recently the subject has been brought to the notice of stock owners and dealers in a very pronounced way, in consequence of the very frequent seizure by sanitary authorities of carcasses of animals which, after being sold in open market as healthy cattle in fine condition, have been found affected on post-mortem examination, and had been confiscated without any compensation to the purchaser, who had acted throughout in good faith, as also had the seller and all other persons concerned in the transaction.

"That the sufferers should appeal to the government for compensation was natural, since they asserted that, (1) The fact that many animals apparently healthy show after slaughter tuberculous disease, and, (2) That there is no ground for seizure and destruction of meat which was perfectly healthy to the eye of the meat inspectors, merely because some of the internal organs were affected with tubercles."

A royal commission has been the outcome of these representations, which is inquiring into the degree of infectiveness of the meat of tuberculous animals.

The same report gives the results of some experiments carried on during several passed years to determine this important point. The following facts are granted, viz.:

(a) Lower animals may be infected with tubercle derived from the human subject.

(b) Bovine tuberculosis is communicable to other animals by inoculation, and by feeding with tuberculous material.

(c) A peculiar character of bovine tubercle, "grapy" form (perlsucht), does not appear in any animals as the result of experiments.

(d) The inference that man is susceptible to infection from the lower animals remains, and must always remain, based on analogy, direct experimental proof being unattainable.

The experiments undertaken were with the intention of determining whether meat of tuberculous origin, yet not containing any obvious tubercles or any tubercle bacilli detectable in microscopic examination, is capable of producing tubercle.

The experiments were carried on in three sets. In the first series, where seven rabbits and six guinea-pigs were fed upon muscle from undoubted cases of tuberculosis in cattle, post-mortem examinations, all within a few weeks (three or four months), showed that ten of these animals, or 77 per cent., were affected with tuberculosis; while five animals fed on milk from cases of undoubted tuberculosis, or on material other than milk from doubtful cases, were all, without exception, found to be in a normal and healthy condition.

In the second series, nine guinea-pigs were fed with tuberculous muscle mixed with oats and bran for five days. The feeding took place in the middle of December, 1890. On January 2, one animal was taken from each of the three cages and examined post-mortem, and not a trace of tubercle was found in any. From the 3rd of January to the 10th, the remaining six were fed with pressed meat juice added to bran and oats; thereafter, on ordinary diet. On the 14th January one died, and was found to have tubercular disease. On the 20th January another died with pronounced disease of intestines. On 22nd January a third was found dead with extensive disease of lungs, liver, spleen. All of the remaining animals of the series showed pronounced tubercular disease, especially of organs of the alimentary canal. The two central animals, fed on bran and oats only, were killed early in February, and were found perfectly healthy.

Here the percentage of well marked cases of tuberculosis in animals fed on muscle or juice was 75 per cent.

A third series of experiments, carried on in Edinburgh, in the laboratory of Professor McFadyean, were negative in their results, and comparable with similar experiments by Nocard and Bollinger. Professor Brown remarks, regarding these three sets of experiments,—"On the other hand, the first and second series of experiments leave us no room for doubt that meat taken from tuberculous cattle, the tubercle being trimmed off without any special precautions, exactly as is done by the butcher, is capable of causing the disease in animals which partake of it in a raw state. The further question of the degree of cooking which is necessary

to destroy the infective character of the meat, has yet to be determined by experiment."

I have made this reference to diseased meat, since it is intimately related in its bearings to the question of the power of milk to transmit the germs of disease, as tuberculosis.

From Koch's first experiments, and from those of numerous investigators since, it seems to have been proven beyond doubt that tubercular nodules in the udder are a source by which the bacilli of tuberculosis are directly transmitted with the milk. This point seems to be settled as definitely, as that flesh with tuberculous matter in it is infectious. That this danger is a serious one, is seen from German statistics already quoted, and from other data where, as in Edinburgh, of 660 cows, 37 had tubercular mammitis. How far milk from tuberculous cows with no tuberculous nodules of the udder is tuberculous (as far as clinical examination goes), is a question of even greater importance than that of whether or not meat with no tubercles is capable of transmitting the disease.

Some recent experiments in Denmark seem to show that the danger, at this stage, of transmitting tuberculosis is not very great. The question, however, of at what stage the milk of a cow affected with progressive tuberculosis becomes dangerous, or infected with bacilli, is one of such paramount importance that it is one which we may very properly consider. The following are the most recent conclusions on the subject, based upon actual experiments:

The report of the recent Paris Congress on tuberculosis does not seem to have added any special light on the subject; but the experiments carried on by Dr. Ernst, of Harvard University, seem to have been so extended and thorough as to leave no doubt as to the dangers from this source. The report states that veterinarians give instances of the infection of calves from tuberculous mothers; and that this is true is undoubtedly shown from M. Vignal's experiments, as related at the Paris Congress, from which the conclusion is drawn that it is transmitted from mother to fœtus during pregnancy only in extremely rare cases.

In Dr. Stone's experiments, conducted under Dr. Ernst, 126 separate microscopic examinations of milk from affected cows were made, and in sixteen instances the tubercle bacillus was found, or in 13 per cent. of cases. The report further says,—

"By inoculation of the same milk in rabbits and guinea-pigs, in seventy-four inoculations we produced six cases of tuberculosis, the inoculation being from only one to three drops of milk. This means in 8 per cent. of rabbits and in over 13 per cent. of guinea-pigs.

"From feeding experiments with twelve pigs, nearly 50 per cent. became tuberculous, and of twenty-three calves, eight, or 23 per cent., became tuberculous."

That the milk in public supplies may be dangerous has been shown by tubercle bacilli being discovered in mixed milk in Boston, and also from

Forster's experiments, who found that tubercle bacilli may exist in milk for at least ten days.

How much value can be placed upon these experiments, viewed from the practical stand-point, cannot yet be determined; but it is fair to say that if an inoculation of milk is made with many forms of bacteria, they seem to find milk to be a very good culture medium. That all, however, is not known on this subject must be confessed, and that the fluid tissues of the body and their secretions exert in their normal condition certain protective influences against the invasion of disease has been established beyond doubt.

Many are doubtless familiar with the results of the remarkable experiments which have been carried on during the last three years, growing out of Metchnikoff's phagocyte theory. From these it becomes evident that there is another element in the immunity of certain animals against certain diseases, while the same animals will succumb to other diseases. That, for instance, blood serum exerts a certain bactericidal influence is known by foreign researches, as also by those of Professor Prudden. At this point comes the difficulty of deciding what constituent of blood serum possesses the power; and hence it has come about that certain nitrogen compounds have been extracted from the serum, which, when inoculated into animals, produce immunity in certain directions. These compounds have been called tox-albumins, or defensive proteids; and the theory of their action in creating immunity has been stated by Hankin as follows:

"Immunity, whether natural or acquired, is due to the presence of substances which are formed by the tissues of the animals rather than by those of the microbe, and which have the power of destroying either the microbe against which immunity is possessed, or the products on which their pathogenic action depends."

The important influence of these recent studies on our views with regard to the transmissibility of bacterial diseases cannot be overlooked, and doubtless are of much value; but there are two conditions which, in connection with our present subject, must necessarily exert a potent influence on the normal quality of cows' milk:

The first of these is the healthy condition of the cow at the time of milking, and the second is the preservation of milk in a condition as nearly akin to its normal condition as possible. Without argument, it may be assumed that cows' milk cannot be normally secreted from tissues that are not in a normal condition. Experience has further shown that by injections into the blood, of chloroform, atropine, etc., alterations take place in the blood by which immunity is removed. For instance, Klein produced anthrax in rats after having administered chloroform, it acting as a depressant. Some of these blood changes are readily observable, and, as would be expected, such changes show themselves by alterations in milk,—a normal secretion of the tissues. Take the disease of tuberculosis in cattle: after both feeding and inoculation experiments, it is seen that a daily rise of temperature in rabbits, pigs, calves, etc., takes place

of 3° or 4° F. Similarly, although no tubercles of the udder may be present, a daily rise of temperature tends to take place. This has been known, in advanced cases, to produce a stringy condition of milk and a precipitate on standing.

Now these facts may be taken advantage of in a practical way in our efforts to determine what constitutes a normal milk. Thus we are brought naturally to the study of milk as a physiological product. Whether viewed simply as a constituent directly of the blood itself, obtained by osmosis, or as a secretion elaborated in the cells of the milk glands, it is found to have in a normal state certain very well defined relations existing between its various constituents. All know the normal constituents in milk to be as generally stated, fat, and solids not fat, which latter are composed of sugar, proteids, and ash. For many years chemists, and of recent years agriculturists, have been intently engaged in determining, from the commercial stand-point, the relative proportions of these, and especially of the so called butter-fat. For our present purposes it suffices to know that different breeds, and different animals of different breeds, give milks which are normal, and yet whose constituents vary notably within certain very well defined limits. Knowing these facts, chemists and others have argued that there is really no such thing as a normal milk standard possible; but these have argued from a limited knowledge of the facts, or, more probably, limited opportunities for drawing general conclusions. Very recently it has been found that while the butter-fat in different animals may notably vary, yet if the cow is known to be healthy, and no abstraction of fat nor addition of water has taken place, the several constituents of milk bear to one another a tolerably definite relationship. Contrary to the old idea that milk high in cream or butter-fat would show a lessened amount of other constituents, it is now known that with the percentage of butter-fat high the other solids are present in a proportionately larger amount. Thus, Professor Cochrane, Analyst to the Pennsylvania Board of Agriculture, gives the following results at 60° F.:

No.	Sp. gr.	Fat.[1]	Total solids.[1]	Solids not fat.[1]
1	1029.6	3.38	11.33	7.95
2	1030	3.62	11.93	8.31
3	10.29.3	3.63	11.63	8.02
4	1033	5.70	15.64	9.94
5	1034	5.35	14.87	9.52
6	1034	5.19	14.70	9.51
6	1034	5.88	15.48	9.60
8	1034	5.05	15.69	9.64
9	1034.3	5.95	15.60	9.55
10	1035.2	5.70	15.60	9.90

Hence, it is very properly concluded that the lactometer, or the lactodensimeter, is an instrument of much value in testing a milk from the stand-

[1] Per cent.

point of adulteration. Thus, a milk of low specific gravity and low in solid constituents would indicate the addition of water; a milk of high specific gravity and a low percentage of fat is probably skimmed; and a milk having a low specific and yet a high percentage of fat indicates either a very good milk watered, or an unfair sample taken from the creamy portion of the milk.

From many thousand analyses made by Dr. Paul Veith, F. C. S., Analyst for the Aylesbury Dairy, London, England, during eight years, broad general conclusions have been drawn. During those eight years he analyzed 84,746 samples of milk, and has preserved records of great value, from which the following are some of the more important deductions: He found that the non-fatty solids are the most constant factors in milk, having the following relations to one another:

Total non-fatty solids.
- $1\frac{6}{2}$ . . the milk sugar,
- $1\frac{1}{2}$ . . mineral matter (ash),
- $1\frac{5}{2}$ . . the nitrogenous matter ($\frac{2}{3}$ of this being caseine).

He likewise found that milk from cows fed with the same foods shows a remarkable constancy of specific gravity, rarely falling outside the limits of 1,030 to 1,034.

As regards quantity, he found that the morning milking stands in relation to the evening as 100 to 72, accounted for, he thinks, by the fact of the cows having before them water during the night, and no food after the evening meal. The great increase shows a difference in quality, but not of an amount to offset the difference in quantity. Thus, analyses made on eleven different days showed in one cow (a type of the others) that the amount of pounds of milk-yield averaged

14.4 pounds at morning milking,
10.2 pounds at evening milking.

Fat solids.
- 3.5 per cent. at morning milking,
- 4.1 per cent. at evening milking.

Non-fatty solids.
- 9.13 per cent. at morning milking,
- 9.32 per cent. at evening milking.

That these results are constant, may be seen from similar experiments made at the Agricultural college, Guelph, Ont. The following are the results of the average of one week's examination, by Prof. C. C. James, of the milk of six cows by the Babcock tester to show butter-fat:

Cow.	Morning milk.	Evening milk.
No. 1	3.25 per cent.	3.96 per cent.
2	2.76 "	4.00 "
3	3.18 "	4.33 "
4	3.42 "	4.45 "
5	2.75 "	4.18 "
6	2.63 "	3.70 "

Dr. Veith further found that the quality of milk reaches its height in November, while in the spring months the poorest milk is received, with another depression in July. The returns were gathered from thirty to fifty farms, and fresh milch cows are obtained at all seasons of the year. It would therefore appear that at these seasons the variations depend upon climatic changes, since the amount and kind of food consumed on the same farms is much the same throughout. There can be no doubt that an influence of an important nature is exerted by weather changes. Thus, a sudden fall in the barometer, and a raw easterly wind, will in twenty-four hours lessen the yield of one hundred cows by a number of gallons; and a sudden accession of severe cold will, for a day or two, notably lessen the milk-flow. Great heat in the summer similarly affects the milk-supply. But the most notable differences depend upon the kind, amount, and methods of feeding. The physiological factor, the perfect or imperfect metabolism of digested products,—in other words, the character of the soluble constituents of food entering the stomach and the digestibility of other foods,—forms the most potent factor, under ordinary conditions, in influencing the amount and quality of milk. Ensilage of any kind will give to milk its special flavor, and produce a certain quality as regards richness and permanency; so also will such foods as bran and various ground grains; and the same is the case with brewers' grains, fresh or fermented; refuse starch-products, and so on to distillery slops.

Now while there is no doubt that milch cattle become habituated to certain foods unnatural to them, yet the experience of close observers shows that milk always has a physiological normal constitution dependent upon the perfect metabolism of wholesome grains and grasses, and that other foods do produce in some degree abnormal products. All dairymen are aware of how leeks in spring-time flavor the milk, and dairymen are very well aware that so simple a thing as turning cows from permanent pasture into a clover-field will produce so notable a taste as to cause complaints of something having gone wrong in the milk.

This subject opens up a wide field for investigation, which as yet has received but little attention, even from the sanitary stand-point. From more or less general experience, the impression exists that the milk of cows fed with refuse grains and ensilage, all including some starch or sugar more or less altered by the alcoholic or acetic ferments, has not the keeping properties of the milk of cows fed with hard grains and grasses. The diarrhoeal troubles in children have not infrequently been attributed to this cause. I am not aware of any extended experiments going to show that such milk contains an excess of sugar, and, as already mentioned, Dr. Veith states from his many analyses that sugar maintains its average proportion of one half to the non-fatty solids of milk, and that these constituents maintain throughout a remarkable relative constancy. On many of the farms of the Aylesbury Company, brewers' grains are fed, but it may very well be that in the English climate fermentative changes are ordinarily slower than in the warm weather of this country.

This point naturally brings me to speak of the acidity of milk, and its relations to normal physiological processes. We are aware that milk is spoken of commonly as being a practically neutral secretion, giving slight reaction with both red and blue litmus,—in other words, being amphioteric. In reality, however, normal milk, owing it was thought to a certain amount of carbonic acid dissolved in it, ought to be considered as acid. Dr. Wynter Blythe by experiment has shown that milk contains, in a litre of fresh warm milk, 1.83 c. c. of gases,—carbon dioxide, .06 c. c. or 3.27 per cent.; nitrogen, 1.42 c. c. or 77.60 per cent.; oxygen, .35 c. c. or 19.13 per cent.; and that standing increases its carbonic acid by a certain amount of oxygen absorbed.

It is questionable, however, whether milk does really contain when freshly milked any appreciable amount of carbonic acid, since by experiments carried on in the laboratory of the Provincial Board of Ontario it has been found that the acid reaction found in milk just drawn does not alter on boiling, by which process carbonic acid would be driven off if present as a free acid. It has further been found that milk, if rapidly aerated and cooled, does not increase in its acid reaction.

The following results of experiments carried on in a large dairy near Toronto by my laboratory assistant, Mr. J. J. McKenzie, will be found of great interest in determining this point:

The standard normal solution of caustic soda (40 grammes to 1 litre of water) was prepared, and added to milk just drawn from the cows into clean sterilized flasks. The point of acidity was delicately determined by pheno-phthalein having been previously added to the milk. It will be seen that the acidity of milk may be represented as having an average of 1.1 in a series of individual milks, or in the mixed milk from a herd of one hundred cows; that is, 1.1 cubic centimetres of normal caustic soda solution was necessary to neutralize the acidity present. As these cows had been fed month after month on fresh cut hay mixed with bran and pea-meal, and on the grass for a few hours each day, it may be said that the food was the best possible for determining what is the normal physiological acidity of milk. From the fact that carbonic acid does not seem to be a factor in this acidity, but that it depends upon some acid basic salts (probably phosphates) present, it will appear that in the determination of the acidity of milk we have a method of much value in not only testing the effects of different foods on milk, but in estimating the changes which go on in milk under the influence of bacterial ferments of various kinds.

At this point I enter upon a part of our subject so interesting and yet so intricate, that I confess to having some fears as to the propriety of my attempting to deal with it; and yet, I am convinced that until the biological factor in the study of milk has been followed with the same assiduity as has the chemical, we are not likely to greatly increase our present knowledge on the subject.

Starting then with the facts just related regarding the acidity of milk, I believe it will be found that, under ordinary conditions, the determination

of the acidity of any milk will serve as a measure of the degree of bacterial infection which has taken place, and of its fitness for use as a food. For instance, in the experiments which I have recently been directing, a milk, which showed 1.1° of acidity both at milking and after aerating and cooling by a method adopted at a large dairy near Toronto, was placed in quart bottles, which had been well washed in a warm soda solution and afterwards rinsed in clean water and drained and aired for some hours, and thereafter placed in a refrigerator having a temperature of 40° to 45° F. These bottles were covered with a flat metal cap and allowed to stand. After five days their acidity was tested, when it was found to have remained unchanged from the normal 1.1°, and the milk, to the taste, seemed in every way normal. Now from this it may fairly be concluded that while the milk must have been infected to some extent with the lactic acid ferment from contact with the sides of the milk pails, cans, and bottles, yet the treatment of the milk by aeration, and its subsequent retention at a low temperature, served to delay for the length of time stated the multiplication of the bacillus lacticus, or, indeed, of any other microbe whose multiplication produces an acid reaction.

These facts lead us to inquire whether the care exercised in drawing the milk, in cleansing cans, bottles, etc., may not so minimize the amount of bacterial infection as to make it possible for the defensive proteids, or tox-albumins, which I assume to be present in milk, to so exercise their bactericidal influence as to actually destroy the greater part of the bacilli lactici necessarily introduced.

Fokker has shown that there is in fresh milk some compound present which actually does exert this destructive influence. From an intimate knowledge and observation for several years of the working of a large dairy and of the keeping qualities of milk, I have for some time been of the opinion that what are known as the animal odors of milk exert an important influence, both directly on the wholesomeness of milk and upon its keeping qualities. It is well known that milk, taken from a healthy cow at night and placed warm into a small pail and covered, will retain flavors to a disagreeable extent, and emit an odor, often very disagreeable. It has, hitherto, I believe, not been seriously attempted to isolate these volatile organic compounds, which by aeration and chilling are so readily caused to disappear, although Wynter Blythe in his examination of the gases of milk might naturally have been expected to recognize their presence. He, however, seems to have found only those gases of which a table of amounts has already been given. That they are highly organized nitrogenous compounds I readily believe, and that in themselves they may in some instances be noxious, I have thought possible. For instance, we are aware that nursing mothers, under extreme nervous excitement of a depressing character, may secrete milk which will cause convulsions in the child; while I have known the milk of a nervous Jersey cow, tethered during the day in a corner of a city park where she was worried by boys and dogs, to secrete a milk which almost invariably was

altered between night and morning so as to be totally unfit for use. Such facts remind us of the curious "Gemeingefühl" theory of Jaeger, whereby, under pleasing mental states or the opposite, volatile odors are produced in the body: in the one case, stimulating the heart to full vigorous pulsations; and in the other, depressing notably the heart's action, and so affecting nutrition.

Whatever be the cause of the conditions to which we refer, we learn from those engaged professionally in dairying that there are many variations in the minor constituents of milk, which seem to notably affect its coagulation, etc. Thus, this albuminous substance seems to vary, notably in amount, according to the age of the milk, and doubtless according to the healthy character of the mucous membrane of the udder and teats.

After making all allowance for these minor variations in the constitution of milk as affecting its wholesomeness as a food, it must be confessed, however, that the care of the milk, in its handling from the time of taking it from the cow until it is consumed, is by far the most important element in the question of its fitness for food. Milk taken under the best ordinary care in stables is by no means as free from bacteria as it might be; but, as too commonly taken, it is absolutely laden.

The following is the result of a bacterial analysis of milk taken by my laboratory assistant in a large stable where the milk is supposed to be handled with unusual care as regards cleanliness: Gelatine plate cultures were poured, one half c. c. of milk being added for each culture. After three days, maintained at the laboratory temperature of 66°–70° F., the various plates gave the following results:

ANALYSIS OF MILK (BACTERIOLOGICAL) AT DIFFERENT STAGES OF TREATMENT.

Average of two samples.

I. Direct from cow; no precautions except milk received into sterilized test tube, 15 microbes per c. c.

II. Pail in stable receiving milk from different cows; milk strained through a cloth, 720 per c. c.

III. Milk from cooling apparatus after cooling, 884 per c. c.

IV. Milk from bottles immediately after filling, 1640 per c. c.

As regards normal milk acidity,—

Oct. 7. Six cows gave the following:—.95, 1.06, 1.27, 1.12, 1.20, 1.09—average 1.11. Kept in all day; 1.11 c. c. of normal soda required to neutralize. Average of mixed milk of 100 cows on cooling, 1.11.

Oct. 8. Cow No. 2 of above series, 1.10; No 3 (back lamed), 1.50; No. 4, 1.00; No. 5, 1.01. Out all day pleasant days. Mixed milk, 1.10. After standing in refrigerator, for four days at 40°–45° F., 1.10; 1.50; 1.00; 1.00—average, 1.11. All milk aerated, but not otherwise sterilized.

These results are remarkable, and illustrate Bitter's (of Breslau) conclusions that air contamination is the merest incident as compared with that

due to the hands of milkers, strainers, and other various utensils used. It is not then difficult to understand how, with a slow process of cooling from 100° F. down to air temperature, very favorable conditions have been present for the multiplication of germs.

It is curious to note how many explanations other than the bacteriological one are given for milk changes by professors of dairying. Professor Arnold illustrated in his work a peculiarity which, during the warm weather of a particular summer, occurred in Rochester milk, by which, after the driving of milk in wagons a few miles from the country, it was found to be coagulated while showing no marked acid reaction. This is now known to be due to certain bacterial forms different from the common acid producing forms.

Speaking of the bacteria of milk, much good work has been recently done on the subject, and some very interesting results have been obtained. Of these, those carried out by H. W. Conn, Ph. D., at the Storrs Experiment Station, Connecticut, are of much interest. He has, as might be expected, found almost innumerable bacterial forms in milk; but there are principally three classes, distinguished by the effects of their action on the milk. These are, briefly,—(1) The bacillus *acidi lactici*, and perhaps allied forms, which change the sugar into lactic acid and carbonic acid, and coagulate caseine into a hard mass, are aerobic, and do not liquify gelatine. (2) The second class curdle the milk without rendering it acid. These forms liquify gelatine, produce spores, and are anaerobic largely. The curd formed by these is soft and jelly-like. (3) A third class, as *oidium lactici*, seem to be common in milk, and yet produce no marked coagulative effects or acid reactions.

That, however, the various decomposition changes which occur in milk, cheese, etc., are due to bacterial action, may be realized from the fact that milks kept under various conditions have shown bacteria ranging in numbers from 300 to 6,000,000 per c. c. How they may multiply is seen by the single illustration that milk which had been kept for several days in a cool place and then showed 10,000 bacteria per c. c., was afterwards allowed to stand in a warm room some six hours, and during this time the bacteria increased from 10,000 to 1,000,000 per c. c.

Now I have intimated enough to fully set forth the fact that milk sterile on milking becomes at once contaminated under ordinary circumstances; but that the rapid development of sourness really depends upon the subsequent conditions.

Fokker, of Groningen (Holland), has given figures showing that for a short time milk seems to resist bacterial growth. For instance, he added a measure of bacterial broth to milk and found that

1 c. c. of milk then contained 120 bacteria;
1 c. c. of milk contained after 24 hours 10 bacteria;
1 c. c. " " " 48 " 2,200 bacteria;
1 c. c. " " " 72 " innumerable bacteria.

He further indicated, what Duclaux and others had pointed out, that the

resisting power of milk is lessened by sterilization, since, if subsequently inoculated, he found it invariably coagulated in twenty-four hours.

But aside from all these special conditions there stand out the broad facts, within common experience, that good milk taken carefully does form, under ordinary conditions, an admirable culture medium for various bacteria, but especially for the common sour milk *bacillus lacticus*. I give but one of our experiments: Four sterilized tubes were filled with milk and plugged with wool; two lots being directly from the teats of the cows after careful washing, and two from the mixed milk after aeration and cooling. All were exposed to the laboratory temperature, and at the end of thirty hours all were coagulated, and showed practically the same degree of acidity measured by the normal alkaline solution.

From the results of the plate cultures already given, we have seen that the milk at these two stages showed a very notable difference in the number of bacteria present; yet in practice this amounted to very little, so long as any inoculation at all had taken place and the temperature was favorable for rapid bacterial growth. On the other hand, as might be supposed, there are degrees of purity as regards bacterial contamination; and a milk, if carefully taken, is much more likely to remain sweet if kept cool than if much contaminated.

Bitter has found that milk in sterilized and unsterilized cans varies greatly in keeping properties after Pasteurization. Thus:

Sterilized cans.	Unsterilized cans.	Temperature.
46 hours.	24 hours.	23° C.
96 "	48 "	15°
72 "	24 "	23°
130 "	65 "	14°
86 "	48 "	19°
104 "	66 "	14°

But that temperature is the main factor, has similarly been shown by Bitter in his experiments with Pasteurized milk. Thus, when heated to 68° C and thereafter chilled, the following results were obtained:

At	30° C	milk	remained	good	6–8	hrs.	longer	than	un-Pasteurized milk.
"	25°	"	"	"	10′	"	"	"	"
"	23°	"	"	"	20′	"	"	"	"
"	14–16°	"	"	"	50′–70′	"	"	"	"

Bitter has determined after numerous experiments to make an arbitrary standard of goodness of milk by counting the number of bacteria in the sample. Milk, according to this scale, is good if the number of bacteria falls under 50,000 per c. c. Above this it becomes doubtfully good, and when 2,000,000 per c. c. are present it is absolutely destroyed. He concludes that, with regard to the preservation of milk, Pasteurization at 68° to 75° C., is safe at ordinary temperatures; that in hot summer weather it will keep at least thirty hours longer; and that at this temperature the taste and flavor are not altered and cream-production is not affected.

Manifestly, however, with ordinary methods, as we find them, in the care of milk, temperature, of all factors, has the most important bearing on the keeping of milk. I cannot do better than conclude these studies with a quotation from a recent critique, by M. Duclaux, "Sur la stérilisation du lait." He says,—

"It seems to me that in place of always marching forward in this direction, it would be useful to retrace our steps, and to ask ourselves if it would not serve better if we should avoid all necessity for heating, in preventing absolutely the introduction of all hurtful germs into the milk. In the Conference, held on 7th June, 1889, in the Trocadéro, during the Universal Exposition, I said, 'that milk, properly taken, in a stable properly kept, by a milker who had first washed his hands and the teats of the cow, would not coagulate more quickly than milk taken without care, and having carbonate of soda added to it to mask the defects of cleanliness.' . . 'It seems to me that in this direction lies progress, at least for milks destined for rapid consumption, and not from the side of the multiplication, or making perfect, of apparatus for Pasteurisation.'"

Summing up, then, some of the practical conclusions to be derived from our studies, I would briefly formulate the following, as methods likely to conduce to an improvement in our public milk-supplies:

1. After intelligent dairymen have selected their cows, it is especially desirable that a system of periodic veterinary inspection, in addition to the dairyman's inspection, be exercised, under the Municipal Health Department, of all milch cows supplying milk to the municipality.

2. From what has already been said it is manifest that strong views should be held and taught regarding the nature and quality of the food of milch cows, whose milk is intended for public supplies. Not only has it a direct influence on the general health of the cow, but the condition of the milk at the time of taking, and also its keeping qualities, are undoubtedly in no small degree dependent on the character of the food-supply. All decomposed foods, as those which are liable to undergo fermentation, should be wholly avoided. As already mentioned, the best foods are the well ripened grains and grasses, well cured and free from weeds, fed in such a manner as to supply the various milk constituents in proper amounts, and in such a way as to promote easy digestion and proper assimilation.

3. The stables of the cows are manifestly a point of great importance. Too often, dark, damp, ill ventilated, and crowded pens have been the home of this chief of our food-supplies. It is quite possible, as hundreds of dairymen and farmers have shown on this continent as on the old, to keep, even on a large scale, a dairy stable free from the ordinary disagreeable stable odors, to give the cows abundant ventilation, and to so conduct the feeding, that cows, taken from the ordinary barn-yard feeding of the farmers, will readily improve in general appearance, and increase greatly in milk and in flesh. The water-supply to the cows is of equal importance. Too often, the barn-yard pool, or sewage-tainted creek, or cheese-

factory drainage, are the sources from which the dairy cattle drink; and, not even to mention the more delicate physiological effects of such water, cheese-makers tell us that they can distinctly note the gross effects of cows drinking filthy waters by the degraded quality of the milk which, at times, comes to their factories.

4. The care of the milk at the time of, and subsequent to, taking, is, however, of all points at once the most difficult of control and the most necessary to supplying a wholesome milk. We have pointed out wherein the difficulties lie, and would only say, as Duclaux has said, "Cleanliness everywhere is the *sine qua non*." That it means almost a revolution amongst farmers and dairymen, as regards their methods, is apparent; but, as Duclaux neatly says, "Producers will quickly find the means (of cleanliness and a reform in their methods) if consumers wish strongly. When people demand clean milk, they will have it. They will always have to boil milk before using, when they are not sure of the condition of the cow that furnished it; but the question will not the less have taken a great step in advance when milkmen and milkmaids know all that is implied in cleanliness." Hence, the sterilizing of the cow's teats by washing, the sterilizing of all cans and bottles by steam or dry heat, and the boiling of all cloth strainers will be necessary. Aeration and rapid cooling are of enormous influence in delaying, as we have seen, the multiplication of bacteria, and I am convinced that the placing of milk in a refrigerator over night, at 40°–45° F., and allowing the cream to rise in well stoppered bottles, conduce together to the greatly increased permanency of the normal milk condition.

5. The delivery of the milk is similarly of prime importance. If placed to cool in sterilized bottles, at a low temperature, the layer of cream tends to prevent agitation in the bottles, and where the bottles are packed at the same time in accurately fitting compartment-boxes, these exactly fitting into wagons specially designed for them, the agitation or disturbance of the milk in transit will be reduced to a minimum, and the introduction of oxygen is lessened. The numerous details in this regard need not be further referred to here.

6. Finally, when the milk has reached the consumer, it must be placed in a refrigerator, or promptly consumed. If in the former, I have known milk in summer weather to retain its sweetness for three or four days when precautions such as I have spoken of are present.

7. In case the Pasteurization of milk is introduced into practice by dairymen, it is necessary that the same care should be exercised in keeping milk cool, after heating to 68° or 70° F., as is necessary under ordinary treatment.

In conclusion, I may say that it is my opinion, after very carefully studying the processes and results of a large dairy for four years, that, with carefully selected and inspected cows, as regards freedom from disease, notably tuberculosis, the taking of milk with care as to cleanliness in the particulars already given, to aerating the milk to remove the volatile ani-

mal gases, to bottling in sterilized and well stoppered bottles, and the placing them promptly thereafter in cold storage, at 40°–45°F., with careful handling in delivery, will be found to present so many practical advantages, both as regards the tastes of the consumer and the convenience of the dairyman, that sterilization in other respects will not be likely to be found necessary, or find general adoption.

XVII.

RABIES—ITS PREVENTION AND TREATMENT.

By J. J. KINYOUN, M. D.,

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The term rabies, or hydrophobia, is now applied to an acute, infectious malady transmissible from animal to animal. It has never been demonstrated that it ever does, or can, exist outside of the body, nor does it occur spontaneously. Its etiology and pathology can be no longer confounded with other diseases having like symptoms, owing to the researches and brilliant discoveries of Louis Pasteur.

Its distribution is general; in almost all countries the malady is prevalent. Variations of temperature appear not to have any influence in checking or preventing its spread when once it gains a foothold. The chief agents in propagating this dreadful malady are the canine and feline species. Epidemics have, from time to time, broken out in various parts of the world, causing a large loss of life. In nearly all instances they have been traced directly to the dog as their origin.

It prevails, to a greater extent, in the civilized countries,—especially Europe. France, Spain, and Russia report the greatest number of cases in man. The mortality appears to be greatest in southern and southeastern Russia,—where it is mostly contracted from epidemics occurring among wolves, which infest that country. The great number of cases occurring in that sparsely settled country are due, in part, to the manner in which the people live. The inhabitants are segregated in small villages, and a rabid animal entering one of these may play sad havoc before it can be killed, or make its escape.

In former times, rabies was very prevalent in Sweden and Germany, but now a case seldom occurs there, owing to the strict police regulations enforced for several years past. Australia is the only country known where the disease does not exist, and it will probably never gain a foothold their so long as their excellent quarantine regulations are in operation.

The popular idea, that the disease is one of hot countries, or that it occurs only during the summer season, is erroneous. From statistics gathered in France, where at present the disease is most prevalent, the months of December and May show the greatest number of cases. Much has been written during the past few years of this disease in Europe, and accurate statistics have been tabulated; little or nothing has been said about the prevalence of the disease in this country; it exists, and a great

number of cases occur yearly, both in man and among the lower animals. It is a lamentable fact that so little has been done by the medical profession in furnishing accurate reports of cases among persons affected with rabies. Occasionally an isolated case is reported by a medical man, but this appears to be the exception, not the rule. The most reliable information that can be had at present is from the daily press: although this is not an infallible source of information, especially on medical subjects, some heed must be given to its reports. During the last year, fully thirty cases have been submitted of persons dying affected with rabies. These occurring in cities and towns, it is safe to infer that fully as many more occur in the rural districts. We call to mind at least four cases, occurring in one neighborhood, that were not reported. The disease very frequently is not recognized because of the absence of the classical, if not mythical, symptoms, which the human subject is supposed to manifest.

Its distribution in the United States and Canada is general, no part of the country being exempt. In some localities the disease prevails to a greater extent among animals; these are, notably, northern Texas, New Mexico, and Arizona, where perpetuation is due to a species of the skunk family, *Mephitis mephitica*, this species of skunk being a small black animal having three white stripes down its back, and is about one half the size of those found in the Middle and Western states. It is the popular opinion that this animal never bites except when rabid, and that during certain seasons it is apt to become rabid, and will attack any creature it may encounter, even entering houses for this purpose. It is known in that section of the country as the hydrophobia skunk: its bite is usually followed, very shortly, by the disease. Generally, however, the origin and perpetuity of hydrophobia are among the canine species. The period of incubation varies from six days to over one year, the usual time being about forty days: it is a rare instance for the disease to manifest itself after six months have elapsed. The virus exhibits different degrees of intensity in different epidemics: sometimes the effect is delayed beyond the usual time, while in others it is much more speedily accomplished. When the disease is induced by inoculation into the cerebro-spinal canal, the effect becomes constant. "Street rabies" manifests such a wide variation in its period of incubation, that it invites inquiry as to the cause.

From a large number of experiments conducted by Roux in the Institute Pasteur, he found that to induce the disease in an animal the virus must find its way to a nerve, and through this channel reach the central nervous system. The rapidity upon which its action depends is in proportion to the size of the nerve, and the distance intervening between it and the brain: should only a small terminal filament of a distant nerve be wounded, a longer period of incubation will result. This explains why bites inflicted upon the head and upper extremities are so fatal. The virus must reach the central nervous system before the phenomena occur. Pasteur employs three methods of transmitting the disease,—1st, by intra-cranial inoculation; 2d, in the eye; 3d, in the deep muscles of the neck. A most curious

and important result was accidentally obtained during the inoculation from one to another of certain animals with rabic virus. When it was carried successfully through quite a number of monkeys (the first animals used), the virus in some way became so attenuated that immunity was conferred upon certain of the number: as this virus could only be preserved for a short time, Pasteur's attention was turned to the effects upon rabbits and other small animals. When the rabic material was introduced into the sub-arachnoidean space, the period of incubation became shorter and shorter on each passage; when it had passed through about seventy, the period became as short as six days, animals dying on the tenth or twelfth day. This virus has remained constant in its effects from that time until now, a period of over seven years; it forms the basis of preventive inoculation, and is termed "virus fixe;" it has reached its 292d passage. This line of experimentation has been crowned with long-hoped-for success, and made his wonderful treatment for prevention possible. The virus appears to be intensified by this procedure, and promises to be constant in its effects for an indefinite period. The symptomatology of rabies, whether produced artifically or from a bite, is the same, differing in degree only. In animals, where the sensory nervous system is highly developed, there are more disturbances manifest during the first stage;—examples, man, horse, and dog.

There are three stages of the disease,—1st, excitement of both motor and sensory systems; 2d, incoördination; 3d, paralysis. The pneumogastric is profoundly afflicted from the beginning. At what stage of incubative process does the animal become dangerous? Roux has satisfactorily demonstrated that before any symptoms of rabies are apparent in an animal, the saliva becomes virulent, usually two or three days before the first symptom. At the time it becomes virulent, there is an increase of usually a degree or more in the body temperature. When this occurs, the peripheral nerve terminals are stimulated in some way, and the secretions of salivary and lachrymal glands eliminate this peculiar poison: this can, in part, be accounted for, owing to the peculiar nerve termination within the specific cells of these glands, which appear to be modified nerve protoplasm. Recognition of the disease objectively is not an easy task, whether in man or beast, especially in the first and second stages. In suspected cases, occurring in dogs, the animals must be held under observation until the disease has fully declared itself. Another method, and the one most practised, is to kill the dog, if suspected, examination being made by inoculation of some portion of the nervous system into smaller animals. But this last procedure cannot be recommended in event of a person's having been bitten, for then it becomes an absolute necessity to determine at the earliest moment whether or not the animal is rabid. If the third stage of the malady is present in the animal, little or no difficulty will be encountered in demonstrating the disease. An examination of the dog's stomach will be found amply sufficient to clear away any doubt. The pathological changes found post mortem

are few. Aside from characteristic lesions found in the stomach, and a congestion of the spinal meninges of the brain and cord, there is nothing pathognomonic. Some observers have noticed that in the induced rabies, there is a slight suppurative process found in the meninges; this, evidently, was from accidental infection, and not from the disease itself. The cause, whatever it may be, is located in the nervous system, and is excreted by certain glands. Its life history points to the existence of a micro-organism. Its behavior in the presence of inert gases is identical with anærobic bacteria. The virulence can be preserved indefinitely in vacuo, or atmosphere of hydrogen, nitrogen, or carbon dioxide. It is rapidly destroyed by oxygen, or by drying in the air; it is highly sensitive to heat, especially after having been removed from the body; owing to its strictly anærobic properties it does not exist in the blood.

Prophylaxis.—This disease is so wide-spread in our country, that active measures should be taken to eradicate it. Such a result is not impossible, as has been demonstrated in countries wherein at one time the disease was prevalent, but is now a rarity. Germany, Switzerland, and Sweden have almost completely overcome it by their strict quarantine regulations, and orders for muzzling all dogs. Germany at one time suffered severely from its ravages, on account of the peasantry keeping a large number of dogs which they used as beasts of burden; and their intimate association with these was a frequent source of rabic infection. The muzzling order has now been in effect for the last decade, and has been the means of completely banishing it from within the borders of the state. Sweden prohibits the importation of dogs, and thereby diminishes her liability to the disease.

Australia has had for many years a wise provision in her public health laws regulating the importation of dogs. No dog can be landed in that country until it has been quarantined for six months, a period covering the time of incubation in the larger proportion of rabid dogs. Compulsory muzzling should be the rule everywhere until the same result has been obtained as in Germany. Nearly all the municipalities have at some time passed ordinances concerning the taxing, confining, or muzzling of dogs. These statutes, so far as the average American is concerned, are dead letters: little or no heed is paid to them, and they are forgotten by the officials, who, as a rule, are more interested in politics than in public health or sanitation. Sometimes, when a case does occur, and with it perhaps a loss of human life, the officials bestir themselves in their officialism, issue proclamations for muzzling dogs, etc., then relapse into the same old rut as of yore. What is the cause of all this? Can it be that these people who are in charge of our local government are wilfully careless of the laws of preservation of the human life and health entrusted to their care? On the contrary, they are willing to be advised, and wish to do whatever is necessary, provided they have moral support. The medical profession must take the initiative, and direct in all such matters; without a faithful coöperation of medical men, the authorities can never accomplish much in sanitary legis-

lation. To medical men and to the authorities of cities and towns belongs the work of educating the people at large in the matter of properly understanding the gravity of such a malady, and of taking initiatory steps for bringing about a general harmonious action for thorough legislation on this important subject. The sooner it is understood that rabies is a disease as well established in its pathology as any of the acute exanthems, and when there is less reliance placed in cauterizations and the celebrated "mad stone" for the cure of rabies, and a proper appreciation of more rational treatment, the mortality will be proportionately lessened. The methods applicable to our country are,—

1. Quarantine of all imported dogs;
2. General muzzling of all dogs;
3. Preventive treatment of the disease in men.

The preventive treatment at the Institute Pasteur is fraught with most brilliant results. Since the commencement of the treatment in 1886, the mortality has steadily declined as the methods have become better understood. Another factor of success is, that the medical profession of France properly appreciate the importance of preventive treatment being undertaken as early as practicable. The disease is quite prevalent in France and Belgium, but no restrictive measures have as yet been taken in muzzling their dogs. The Institute Pasteur, established now for four years and built entirely by public subscription, is a lasting monument to the wonderful discoveries of its founder. That this institution receives an annuity from the state is the greatest tribute of appreciation ever paid to any man who has allied himself to the medical profession.

Similar institutions for the treatment of rabies have been established in various countries: In Russia, 7; Italy, 5; Spain, 1; Austria, 1; Hungary, 1; Cuba, 1; Brazil, 1; Argentine Republic, 1; Mexico, 1; England, 1; United States, 2—a total of twenty-one places where treatment can be had against rabies. Statistics issued from the Institute Pasteur are as correct as statistics can be made.

Cases coming for treatment are divided into three classes, designated as A, B, and C.

Class A comprises those bitten by undoubtedly rabic animals, demonstrated so experimentally; class B, Cases affirmed by a veterinary certificate that the animal was mad; Class C, Patients bitten by animals suspected of rabies.

It is further required that in all cases practicable a specimen of the nervous system, brain, or spinal cord should accompany each case. Over fifty per cent. of the cases classed A, B, and C are accompanied with specimens, and eighty per cent. of these are from rabid animals. Thus it is readily seen that a large proportion of the cases have been actually exposed to infection; and, if comparison be made with older statistics, it will be conclusively shown that there exists a wide difference in the rate of mortality.

Statistics since the Institute has been opened are as follows:

Year.	Number cases.	Deaths.	Percentage of mortality.
1886	2671	25	·94
1887	1770	13	·73
1888	1622	9	·55
1889	1830	6	·33
1890	1546	5	·32

In similar institutes furnishing similar tables of mortality, the ratios are the same as those given above. In Buda-Pesth during the last year the percentage of mortality was slightly lower than at Paris, and most of the cases had contracted rabies from rabid wolves, which are far more dangerous than ordinary dogs.

METHOD OF TREATMENT.

The principle involved in preventive inoculation is to induce a mild attack of the disease in a comparatively short time, before the primary inoculation has had time to take effect; then, before the primary virus reaches the brain, the system is rendered immune by the secondary inoculation. The mortality is due to two causes,—1, to delay of preventive treatment; 2, to bites about the head and face, where the distance is so short between the injured nerve and the brain that the virus traverses the nerve and reaches the brain before any protective effect can be had from the inoculations. Treatment consists in inoculating the person with a minute portion of attenuated virus from day to day, each day becoming stronger and stronger, until, at last, all but the intense virus is used. A series of rabbits is inoculated with the virus size, which kills them with the utmost regularity. The spinal cords are removed—all precaution being taken against infection as soon after death as possible—and are suspended in sterilized bottles, the bottoms of which contain a quantity of caustic potash or soda. The series of cords, twelve in number, is always kept on hand owing to the fact that one cord is thus prepared from day to day. These are placed in a room especially prepared for the purpose, and kept constantly at 23° C. The preparation of the cord is as follows: A small portion which has been dried for a certain number of days, is rubbed up in sterile conical flasks by means of glass rods, and an emulsion made by the addition of ordinary sterilized bullion of $\frac{1}{10}$ per cent. strength,—2 c. c.'s to each dose, which is one half of the cord. A series of cords is thus prepared, comprising those of the fourth to the sixteenth day's drying. For inoculation of patients the following method is used:

First day's treatment, 2 c. c. each of emulsion of cord dried 15–16 days.

Second day's treatment, 2 c. c. each of emulsion of cord dried 14–13 days.

Third day's treatment, 2 c. c. each of emulsion of cord dried 12–11 days.

Fourth day's treatment, 2 c. c. each of emulsion of cord dried 10–9 days.

Fifth day's treatment, 2 c. c. each of emulsion of cord dried 8–7 days.

Sixth day's treatment, 2 c. c. each of emulsion of cord dried 7–6 days.

Seventh day's treatment, 2 c. c. each of emulsion of cord dried 6 days.

Eighth day's treatment, 2 c. c. each of emulsion of cord dried 6 days.

Ninth day's treatment, 2 c. c. each of emulsion of cord dried 6 days.

Tenth day's treatment, 1½ c. c. each of emulsion of cord dried 5 days.

Eleventh day's treatment, 1½ c. c. each of emulsion of cord dried 5 days.

Twelfth day's treatment, 2 c. c. each of emulsion of cord dried 6 days.

Thirteenth day's treatment, 1 c. c. each of emulsion of cord dried 6–5 days.

Fourteenth day's treatment, 1 c. c. each of emulsion of cord dried 5–4 days.

Fifteenth day's treatment, 1 c. c. each of emulsion of cord dried 4 days.

Sixteenth day's treatment, 1 c. c. each of emulsion of cord dried 4 days.

Seventeenth day's treatment, 1 c. c. each of emulsion of cord dried 3 days.

Eighteenth day's treatment, 1½ c. c. each of emulsion of cord dried 3 days.

For cases bitten about the upper extremities, head, and face, a more intense treatment is practised. Gamalia recommends it for the treatment of those bitten by wolves. The inoculations have never as yet caused any disturbances in those not affected. It is quite certain that in Class C many take the treatment who have never been exposed to rabies. All assistants of the institute have been inoculated, and none have suffered in any way therefrom. The apology offered for calling attention to this subject is, that so far not enough importance has been attached to it by the medical profession in America. Moreover, the wonderful success which has been achieved by the illustrious Pasteur in treatment of this disease, marks an era in preventive medicine. The disease is here widely distributed. Cases are occurring from time to time, and apparently increasing numerically. Should not concerted measures be taken to check its progress? Would it not strengthen our position in other matters pertaining to preventive medicine in general?

Here we rest our case.

XVIII.

ANIMAL DISEASES.

By ERNEST S. DUNDAS, U. S. Veterinary Inspector.

Kansas City, Kas.

American Public Health Association, Gentlemen: I have to apologize for not having a paper on animal diseases and animal foods ready for you, but my excuse is a good one, namely, starting up the hog inspection, and carrying on the work of inspection of cattle and sheep, both night and day. As this is a matter of considerable importance to public health, I trust you will accept my apology.

It was my intention to go into the important subject of tuberculosis, and I might make a few suggestions yet. It is time something were done to protect public health from this disease, but there is absolutely nothing being done, and it is considerably on the increase. We often hear of cattle dying in some section of the country, and naturally the owner, fearing that he will lose the whole herd, at once ships his cattle to market. The disease proves to be tuberculosis on post mortem examination, but the meat is used for human consumption. Some of the cows having tuberculosis are possibly sold to some dairy men, the milk is undoubtedly infected, and the human consumers, especially children, are liable to lay the foundation of an invalid and short life. In cattle this disease is allowed to lie dormant for years, it being slow and insidious, and, being infectious, cows especially will spread it to their calves, and through the medium of milk to man.

If there is a report that cattle are dying from pleuro-pneumonia, Texas fever, or some other bovine disease, something is at once done to stamp it out; but if some unfortunate being dies of consumption, or, as often happens, some fine, healthy young man is suddenly taken down with consumption and dies, nothing is thought of the probable cause. Is there any doubt in this matter? R. Koch has proved, I believe, beyond a doubt, that the bacillus tuberculosis of the human family and of cattle is identical. If this is the case, the milk and meat of tuberculous cattle are sources of danger to public health. This disease can and ought to be stamped out as much as possible. How is it to be done? and what class of cattle are mostly affected with it? In my opinion the Jersey is; therefore that class or breed ought to be watched, as well as all the classes of thorough-bred cattle. I believe the system of inbreeding has something to do with the origin of this disease. Again: The dairies should be held under control by some mode of inspection. But the diagnosis is very difficult, and

an opinion is necessarily carefully given; but if the following clipping from some paper sent to me is a correct discovery and successful, we are on the eve of ultimately stamping out, or nearly so, this much-to-be-dreaded disease.

"*Test for Tuberculosis.*—Owners of cattle are greatly interested in the test for tuberculosis which M. Leon Mandereau, of Besançon, has discovered and applied with remarkable success. A single drop of the aqueous humour of the eye apparently will determine whether tuberculosis is present or not, as tubercle bacilli will be found in the liquid. According to experiments, the test holds good not only when the disease affects the system of the animal generally, but even when it exists only in the lungs or in the liver. It is to be hoped that further experiments will confirm these conclusions, because it is of the utmost importance to be able to detect the presence of the disease, which it has been difficult to do in the beginning of an attack. As the disease is communicable to human beings through milk and imperfectly cooked meat, the question at issue is vastly more serious than any which relates to ordinary cattle disease. If M. Mandereau's test proves conclusive in all cases, it may enable us to stamp out tuberculosis in cattle."

The Hon. J. M. Rush has done, and is doing, much toward removing any danger to public health through meat products. By his mode of inspection, and when the public demands inspection generally, much will have been done to assist the American Public Health Association in its work.

I am satisfied that the department that I represent will do all it possibly can to further the interests of the public health.

XIX.

VACCINE AND VACCINATION:—OBSERVATIONS AND BACTERIOLOGICAL INVESTIGATIONS.

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The opposition to vaccination proceeds chiefly from the failures and accidents that occur from time to time, and even the deaths following vaccination.

Deaths are fortunately very rare, but the serious, and sometimes alarming, illness attendant on vaccinia, has been observed by numerous practitioners. In almost every extensive vaccination in a locality, some cases develop symptoms arousing the fear of the patient, though considered lightly, as a rule, by the physician.

When this source of fear disappears, sanitary science will have accomplished a great step in advance, and disarmed the anti-vaccinationists most effectually on their own grounds. Not only would absolutely pure vaccine result in hushing the cry of danger, but it would, in my judgment, also explain why vaccination so often fails to take, and, if it produces a pustule, sometimes fails to protect, as I will endeavor to show.

Vaccine.—What constitutes pure vaccine? Pure vaccine should consist of absolutely pure vaccinia virus in a fluid secreted from a vaccinia pustule, free from complications, in a perfectly healthy animal of the bovine, equine, or human species.

It is advanced that vaccine virus consists of minute cocci floating in lymph. Microscopic analysis of pustules of vaccinia support this view, but artificial cultures have failed, so far, to reproduce them in a typical, transmissible form. But whatever may be the anatomical and physiological character of vaccine virus, it does not alter the fact that, to be pure, it must be *nothing else* than the material produced in and by a typical pustule of vaccinia, absolutely free from any kind of contamination.

Is it possible in our commercial establishments to produce such absolutely pure vaccine virus? Unfortunately, no. In every institution, no matter how carefully managed (which is far from being the rule), there float microbes of different kinds which contaminate the virus when it is gathered from, if not when it is inoculated to, the vaccinogenous animals.

Does it follow that all vaccine virus is therefore dangerous to use?

By no means. But it does indicate that vaccine cannot be said to be absolutely reliable and of the safest quality, if it contains any dangerous foreign germs whatever, though a few air germs on each point may cause no harm.

Let not any one conclude at once that I am to give an extremist's opinion, to the effect that because nearly all the vaccine in the country is more or less contaminated in some way it is thereby necessarily dangerous in some degree or other, for experience disproves this. In fact, the contaminations are usually with harmless germs, or pathogenic bacteria in such small numbers as to be readily overcome by the organism.

How, then, should vaccine be graded, as regards its purity? Basing his opinion on extensive observations and investigations, the writer would suggest the following:

(*A*) *Absolutely pure.*—Vaccine free from any foreign body whatsoever.

(*B*) *Fairly pure.*—Virus contaminated with harmless bacteria or a few (doubtful) air germs.

(*C*) *Comparatively pure.*—Vaccine contaminated with pathogenic bacteria in very small number.

(*D*) *Impure.*—Vaccine containing pathogenic bacteria in sufficient quantities to make it dangerous in various degrees, according to the organisms present.

(*E*) *Septic and dangerous.*—Vaccine containing a conglomeration of septic bacteria, pyemic forms, or various micro-organisms of decomposition, and septic affections of different types.

This classification has been arrived at after numerous microscopic analysis, artificial cultures, and inoculations in man, cattle, rabbits, mice, rats, and fowls, at different times, during many series of experiments begun in 1887 and carried on at distant intervals to this day.[1]

In the course of these researches, carried thus slowly because of imperative duties in other directions, the writer has tested over a hundred different specimens of vaccine from twenty different sources in America and Europe. During these tests he has isolated, by culture, *eight pathogenic* forms of bacteria, and five which produced no lesion of any kind by inoculation to any of the animals mentioned a moment ago.

Of the pathogenic forms were the following:

Streptococcus pyogenesis,
Staphylococcus pyogenesis aureus,
Micrococcus pyogenesis tenuis,
Bacillus pyogenesis foetidus,
Bacillus septicus,
A bacillus of gangrene,
A gangrene micrococcus,
A saprogenic bacillus,
} unnamed.

All of these produced either abcesses, or gangrenous lesions, or local

[1] The work is now being done at the Laboratory of Hygiene Sanitarium, Battle Creek, Mich.

septicemia, or pyemia, or general septicemia in some or other of the animals inoculated.

Out of forty inoculations, seven of each of these bacteria to rabbits, death resulted in sixteen cases within forty-eight hours to six days. In every instance, the particular form inoculated was found in some part or other of the dead organism, and could be reproduced in new cultures.

The inoculations were all made with pure liquid cultures, in doses of from one to three drops diluted in two to six drops of distilled sterilized water.

The non-pathogenic germs cultivated from vaccine lymph were,—

Bacterium termo (which may, under certain conditions, complicate a wound in a deadly manner, though it is not classed as obligate parasite),
Bacillus subtilis,
Bacterium lineola,
Staphylococcus cereus flavus,
Staphylococcus pyogenes citreus.

The latter, though occasionally found in pus, failed to produce disorder by inoculation.

The cultures were made with the greatest care from the lymph of coated ivory points, wiped carefully with sterilized cotton cloth, and left from a few minutes to several hours in distilled sterile water, or from so called pure lymph in capillary tubes, or, again, from vaccine crusts and cones.

Most of these forms were also obtained from scabs of the human arm, but with these my experience is too limited to give much data. I may mention here the case of a mulatto who was vaccinated in the laboratory then in my charge, in the University or Missouri, and in whom a threatening purple swelling followed vaccination, involving the whole arm, and causing very great pain and considerable fever. The septic poisoning was fought by keeping the arm in a long basin of cold water for thirty minutes to an hour at a time, at short intervals during a period of two or three days. The vaccinated point presented what is often called a beautiful pustule. From it I got a coccus and a bacillus, both of which I lost by accident in laboratory manipulations before I could make inoculations.

Among the many tests made, several consisted of direct inoculation of diluted vaccine virus to rabbits and guinea pigs. Of fifty specimens of virus on ivory points, from ten different vaccine producers, seventeen produced a local swelling and induration, and four produced abscesses. Microscopic analyses and cultures made with some of the points of the same specimens, proved that the results were in ratio of the purity or the impurity of the points.

Of twelve half quill tested by inoculation in rabbits, two produced local induration, and one an abscess.

Of sixteen inoculations made with a solution of cone or scab, every one

had a more or less diffuse swelling, and ten had abscesses. Of these ten, two died, and of the four with the enlargement without abscess, one died within forty-eight hours after inoculation.[1]

On the other hand, thirty rabbits were inoculated with vaccine virus in which the microscope and cultures indicated the greatest degree of purity, and there was not a single extensive swelling, not an abscess, not a death, though in fifty per cent. there followed a slight enlargement at the point of inoculation; much smaller than in the preceding cases, and which lasted only two or three days. This possibly may be due partly to the vaccinia germs themselves.

Vaccinia and its Symptoms.—The well known four stages of vaccinia, viz., invasion, papular, vesicular, and pustular, corresponding to the period of redness, the rising of a spot amid this circumscribed red surface, the appearance of a vesicle, and then the forming of a pustule with a characteristic areola, need no description at my hand. What I wish to draw your attention to is not the regular symptoms, but rather the irregular signs in contrast with these.

A true case of well inoculated vaccinia ought to give rise to only mild fever, and as many local pustules as spots have been inoculated on the skin. Occasionally, a few smaller but true vaccinia pustules make their appearance in the immediate neighborhood of the innoculated place, rarely at a remote spot. There should be no diffuse swelling, no angry ulcer, no deep sore, no extensive muscular inflammation, which so often scare those who are their victims.

This is, however, what often follows vaccination. Most physicians, who get but a mild fever with a very slight local inflammation forming the typical areola around the pustule, are not satisfied. They often prefer a large, deep sore and a good diffuse swelling, and, to obtain it, they often scratch an inch or two of epidermis in one or two places on the arm or leg.

It is, indeed, a very common thing to observe extensive and painful swellings, purple oedema, enlargement of the neighboring lymphatics, a large, heavy, deep-seated scab, around the edges of which oozes a sanious secretion. The arm or leg, as the case may be, becomes so swollen and painful sometimes as to be actually helpless. Fever often rises so high as to cause considerable sickness and alarm. At other times, little pyemic abscesses break here and there, and are counted as so many pustules, indicating perfect vaccination.

The writer has become convinced that probably all these symptoms are only so many indications of some form or other of septicemia. He had occasion a few years ago to prepare and purchase vaccine to vaccinate about six hundred people, over three hundred of whom were students; and more than half were vaccinated by himself, and the remainder, under his instructions. The vaccine had been prepared with more care than is usually taken by most of commercial producers, and vaccination was

[1] Later inoculations with crusts gave only seven per cent. of abscesses.

practised neatly. To one set of students, instructions were given to wash the place to be vaccinated; to others, vaccinated by medical students and assistants, no such instructions had been given. Again: A third set were vaccinated privately, at a moment when I did not expect them to come, and washing was neglected.

Observation of nearly all of the cases which were successful showed that thirty-two per cent. of those who did not wash the skin had greater swellings than vaccinia ought to produce, and of these, six had bad arms —serious local ulcers that healed with great difficulty. In most of these cases, the neighboring lymphatics, including the epetrochlean and axillary glands, were much swollen and painful for a considerable time. Of eight young ladies vaccinated on the leg, two had a diffuse swelling, probably increased by exercise, and one of these had a deep-seated, angry, sanious ulcer, which lasted over four weeks. She was very lame, and scarcely able to walk for two weeks.

Among those in which the precaution of washing took place, only fourteen per cent. developed symptoms more alarming than vaccinia pure and simple ought to produce. The vaccine that was used, other than that produced by myself for the occasion, had been purchased in the market without reference to the propagator, and, as it happened, had been produced partly by an Eastern, partly by a Western, institution. The results obtained with these three different vaccines were practically the same.

Two years later (last year) I had again occasion to superintend the production of vaccine for vaccination, in the very same neighborhood,[1] and took occasion to exercise unprecedented precautions in producing the lymph. I saw but twenty or thirty cases vaccinated with this crop: all were doing admirably, one, only, presenting severe swelling and local septicemia, and this was a doctor who had hurriedly vaccinated himself in the laboratory. It was a re-vaccination, and caused a very marked and pronounced lesion, altogether too great, in my judgment, though I did not express myself at the time, for uncomplicated vaccination. Inquiries made on the result of official vaccination of hundreds of people by the city physician, elicited the fact that but eight per cent. had marked symptoms. It may be well to note that no aseptic precautions were taken by the town vaccinators, nor by the people who submitted to vaccination. In all the above, I had reference only to the so called successful cases.

These are the most salient points, showing the symptoms of vaccinia under a variety of circumstances. It only remains to be said on this point, that, in contrast, I have the records of forty-three cases successfully vaccinated with what I thought, after investigation, nearly absolutely pure vaccine virus. Of these, two only developed inflammation extending two to four inches around the pustule, and only in these, and three others, could there be detected any sign of adenitis. In all these cases the disease had a regular course, all symptoms disappearing within ten or eleven

[1] Columbia, Mo. Propagator, D. D. Moss, Mngr. Paquin Vaccine Laboratory.

days, cicatrix forming without any ugly reddish ulcer or sanious discharge, and the scab falling off of its own accord about the eighteenth day, unless pulled off by accident beforehand.

These observations, though not sufficient to establish a law, surely indicate some contamination with foreign micro-parasites, and, when we consider them in connection with the facts adduced by the experiments given a moment ago, they suggest needed improvements.

In order to leave no doubt in my mind, I have made observations on calves, and have made inoculations purposely with vaccinia contaminated with septic microbes. Though cattle are much less susceptible to these bacteria than man, I found occasionally the development of complicated pustules with the symptoms found in man's complicated vaccinia. Occasionally quite an extensive oedema, or hard swelling, seven or eight inches around the vaccinated spot would arise, and septic bacteria were obtainable in the serosity infiltrating the connective tissue, and even in the blood. In one instance, what is known as oedematous septicemia—a most virulent disease—arose.

It may be observed that it is strange one cannot produce a pustule by inoculating these septic microbes alone, nor can one cause their ready introduction and the devolopment of septicemia within a stated number of days after their inoculation in pure cultures. I will answer, that, in the first place, *it is* possible to produce infection in a localized spot, followed by a kind of scab, by rubbing certain septic germs on an abraded surface. But this is not the usual way in which septic lesions are induced in vaccination. The vaccinia virus prepares the field for the septic germs to grow, without which their generation would almost always be impossible. Like most of septicemiae, infection occurring in connection with vaccinia is merely the expression of the growth of one or several septic forms in an already diseased or injured tissue, furnishing food locally for their nourishment, and weakening the resistance of the cells to their invasion.

Another question arises here: If we have such pronounced symptoms and lesions of septic infection in the very tissue wherein vaccinia is supposed to operate, what effect may not the septic growth have upon the vaccine generation? Since the septic symptoms frequently become the most marked and predominate, is it not likely that these microbes take possession of the field and crowd the vaccine forms to the wall, so to speak? May it not be that the sepsines generated locally destroy the very easily killed vaccine virus? A few observations of mine give color to this view. In an experiment on a calf, I noticed that two complicated pustules furnished lymph, which on another calf (a good subject) produced but meagre vesicles that aborted about the fourth day. On the other hand, in two men in whom vaccinia had taken remarkably well, according to a physician,—which were cases of septic complication which I had examined,—good vaccination produced good pustules again two years later. I have several such cases on record, gathered by inquiries, but these are the only two I have verified.

It would appear that in the calves the vaccine virus had been destroyed early after forming the vesicle wherein the septic germs developed: hence the reason why the scanty lymph that was secreted failed to convey vaccinia to the second calf. In the case of the two men the same results seem to have obtained, and left them unprotected, as the last successful vaccinations will prove.

What are the lessons of these observations and investigations? They suggest numerous possibilities, which the physician's mind will readily grasp, bearing on one hand on the vaccine itself, on the other on vaccination. But the most important lesson taught is, that we have over-confidence in the commercial products, and are often criminally neglectful when we employ vaccine virus regardless of its source and mode of preparation. The health authorities are not doing their full duty toward the people if they fail to exercise the authority which they may have to supervise the production of vaccine, or if they fail to seek it by legislative enactments when they have it not.

For my part, from all my observations since 1887, I have reached the conclusions,—

1. That vaccinia need be followed by none of the septic symptoms enumerated here, and which often occur. They are signs of complications.

2. That when such symptoms arise, they are due either to impure vaccine, impure vaccination, or filth afterwards.

3. That impure and dangerous vaccines are often put on the market and reach the family physicians, who use them in their practice, and often count for good symptoms of vaccinia, lesions which are of a septic character.

4. That septic complications come either from germs in the virus, or germs reaching the skin,—chiefly the former. In either case, it is possible to poison the arm septically. Vaccine classed as dangerous is more to be feared than germs on the skin.

5. That in complicated vaccinia, the end is occasionally defeated by the invasion of foreign microbes, and therefore the person remains unprotected, and may succumb to small-pox. It is probably such cases which anti-vaccinationists produce as proof that vaccination does not protect, but is, instead, dangerous and useless.

6. That vaccine producers should exercise as much care in the production of vaccine as surgeons do in surgery, and produce it aseptically as near as possible.

7. That physicians owe it to the people to know that their vaccine virus comes from a reliable institution.

8. That in vaccinating, the ordinary method of scratching, without reference to cleanliness, is insufficient and dangerous. The arm should be first washed with soap and warm water, and then with freshly boiled water with a sterilized sponge or rag, and the scarifications should be made with an equally aseptic instrument. After the vaccinated spot is dry,

cover it loosely with a sterilized cotton cloth for a day or two, to protect from contamination.

9. From my experience, crusts or cones should never be used, for they are rarely pure enough.

10. From tests of human scabs, which are not dwelt upon here, I would not use them. They are often as impure as bovine crusts, and sometimes worse.

11. The vaccine on ivory points has the greatest per cent. in point of purity.

12. That cultures of foreign germs may be obtained from most all vaccines, but only such as show septic germs in dangerous numbers ought to be rejected.[1]

13. It is next to impossible to obtain at all times absolutely pure vaccine from cattle. The purest can be gathered, only under special guard and special protective means, both as regards the animal and the methods used.

Now a word as to vaccine production, and I am done. How are we to obtain absolutely pure virus? It is an extremely difficult matter, in view of the kind of animal it is produced from. But in a general way, I would say that everything—buildings, stables, operating rooms, etc.—should be so arranged and managed that the vaccine will receive as few foreign germs as possible. Even the animals should be shielded from contamination of the inoculated surfaces by contrivances that only practice and a long experience can suggest to the mind. In a word, not a thing should be omitted to secure the gathering of pure vaccine.

I will say, in conclusion, that the habit of almost all propagators of vaccine, to coat the points a second time with virus secreted by pustules from which the first crop was collected a day or two before, is a practice that is very unsafe, because then the surface of the pustule under this secondary scab *always* contains foreign microbes, pus germs, or pus itself, and, unless very carefully washed, the virus collected is bound to contain septic germs of some sort in a dangerous quantity perhaps.[2] Indeed, I am of the opinion that lymph from a secondary secretion is the most fruitful source of danger, and that it should never be used. In a clean atmosphere air germs are comparatively few, and vaccine gathering is comparatively free from danger. However, I reserve my judgment on this point, as I have now under way experiments to elucidate it.

I have purposely omitted a number of tables of experiments,—because they are too long for one reason, and then several experiments are still incomplete. This paper is simply a general report of progress. In the near future I intend to publish illustrations of the results obtained in my investigations.

[1] It is hard to estimate what constitutes a dangerous number. The kind and property of each should be considered. Less than a half dozen such germs should reach an ivory point under ordinary precautions, and few points should have any under the strictest aseptic procedure.

[2] I had intended to dwell in detail on this point, but I find it would take too much time My paper is already too long.

The work on the matter is now being carried on at the Laboratory of Hygiene, at the expense of the Sanitarium at Battle Creek, Mich., where admirably fitted buildings have been built for the purpose, and are now being equipped. The work now consists of several new lines of tests, and many experiments to verify or disprove what former investigations have indicated. The reports contained in this paper are such as seem corroborated by a series of inquiries made carefully at this institution in the month of September.

XX.

THE BATH—ITS NECESSITY AND ADAPTATIONS.

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To thoroughly appreciate the utility of the bath, it is necessary to understand the structure and functions of the skin—the medium through which it acts.

When the skin is looked at with a lens of moderate power, its surface is discovered to be very uneven, and to consist of a multitude of projections or paps—hence the name papillæ. On the palmer surface of the hand and ends of the fingers, where the sense of touch is the most acute, the papillæ may be seen in rows similar to the ridges and furrows of a ploughed field, and so numerous are they that a single square inch comprises upward of 20,000 of them, and every one is supplied with a sensitive nerve. Thus it is that the skin in its entirety is the organ of touch—in touch not with external things only, but equally with every organ of the body—by a system of communication so complete and so incomparably perfect that no effort of the mind can conceive anything with which to compare it. Moreover, at intervals all along these ridges on the palmar surface of the hand and fingers, indeed, over the whole cutaneous surface, among the papillæ, where no such ridges are observed, there are frequent *pores*—little pits, which mark the openings of the sweat-glands. These glands have their seat immediately under the skin in a layer of adipose tissue. They consist of microscopic bundles of spiral tubes, each one about a quarter of an inch long, running through the skin to terminate in the pores. There are in the skin of an average-sized adult about two million of such pores; and to give some idea of the extent of this wonderful drainage system at the surface of our bodies, if it were possible to stretch it out by placing the tubes end to end, there would be about twenty-eight miles of tubing.

The function of the sweat-glands is indicated by the name. Each one is supplied with blood-vessels and surrounded by a thin muscular covering, with contractile power to drive the secretions of the gland onward toward the pore at the surface. There is no opening to these glands in the opposite direction.

Closely allied to the sweat-glands are the hair-follicles, also situated in the subcutaneous tissue. And alongside of each of these is a pair of *sebaceous* glands—the glands which secrete the natural grease with which the hair (and the skin, to some extent) is supplied. And these, too, are

provided with muscles which, by their contraction, force out the oily secretion; and this secretion it is chiefly which produces the unpleasant odor common to persons who neglect the bath. It is more or less common to all persons on those parts of the body, as in the arm-pits and between the toes, from which the air and water are most excluded.

Lymphatic vessels also pervade the skin, running the contrary direction, toward the lymphatic glands, situated beneath it. Their function is, mainly, to aid in draining the skin of the waste products of cell life into the lymphatic system, to be disposed of by other processes. Hence it is, that in persons who do not frequently bathe, the lymphatic glands are overworked, become surcharged and swollen, most frequently recognizable at the side of the neck, which engorgements sometimes result in suppuration and scrofula.

In certain parts of the skin of white persons, and in every part of it in colored persons, there is, besides the cutis and cuticle, of which the skin mainly consists, a third layer between these, which partakes somewhat of the character of both, called the *rete nuscosum.* It is chiefly composed of pigment cells, which cause the darker color of the skin on certain parts of the body in the white races, and of the whole skin in the colored races.

Thus it is observed that the skin, instead of being the mere organ of touch with external things, is, in reality, an exceedingly complex and elaborate organ, richly supplied with nerves, blood-vessels, lymphatic vessels, and an exquisite drainage system, upon which the health of the body in all its parts greatly depends.

Of the nature of sweat everybody is more or less acquainted, but comparatively few persons appear to appreciate its purpose—to regulate the temperature of the body, which for the maintenance of health is confined to narrow limits. A secondary effect of sweating is to remove the *scarf-skin*—the particles of dead cutis which are prone to stick to the surface of the unwashed. It is most commonly observed on the scalp, where it very properly takes the significant name of dandruff, a word derived from two Anglo-Saxon words—*tan drof*—which signify *itch* and *dirt.*

The scarf-skin, in invisible particles, as well as in scales, is particularly abundant after fevers, and especially dangerous after those of an exanthematous character, such as measles, scarlet-fever, and small-pox.

The daily quantity of sweat in an adult, at moderate temperature, has been computed at three pounds; but it is so dependent upon the degree of exercise as to be exceedingly variable. It is always in process, however, in healthy persons, and but rarely suspended in sick ones, insomuch that persons who do not use the bath, those who habitually allow their skins to be continually smeared with the dirty paste that results from an accumulation of putrefying scarf-skin, grease, and sweat, constantly stink.

To obviate this, and to protect and maintain the functions of the skin for the promotion of health, is the purpose of this paper.

Surely everybody, to be clean, requires the bath—infants and children

particularly, because of their greater functional activity; working-people' most of all, because they sweat most, and are, in default of the bath, the dirtiest of all people, but with it the cleanest, because perspiration is promoted by exercise, and the scarf-skin is thereby more effectually disposed of: the skin is consequently cleaner and softer. Indeed, it may be truthfully said that persons who never sweat and bathe are never clean; and lazy people are sometimes detectable by the odor emitted from their bodies.

It has already been observed that the sweat-glands perforate the skin spirally, that the pores are their only opening. That any aqueous solution can be made to enter the circulation by the pores is, therefore, highly improbable. The nature of the exudation from the hair follicles, and the action of the muscles upon them, seem to be quite sufficient, also, to prevent any possible absorption of water through that means. Indeed, it seems abundantly evident that water is not absorbable through the skin; and, fortunately, it is not. Otherwise there would be greatly increased danger from bathing in filthy water; and even sea water in its greatest purity always holds in solution material which would be poisonous in the quantity that might be so absorbed, if absorbable at all, by long exposure to it.

The long endurance of thirst consequent upon the continued immersion of shipwrecked persons, and by others in consequence of the continued wetting of their clothes, is due to the arrest of cutaneous evaporation and to the effect upon the nerves.

Indeed, there is no evidence whatever that the salts contained in sea water or mineral waters are ever absorbed through the skin, even in the smallest possible quantities. Such baths are simply stimulating to the skin, more or less, according to the nature of the salts.

It is well known, however, that if the cuticle be broken—removed by a blister, for example—the denuded surface is actively absorptive; and that when the cuticle is not broken, certain medicines in oleaginous solution, such as the preparations of mercury and some of the alkaloids, may be introduced by friction. But these conditions are wholly apart from those common to the bath.

It would extend this paper to inordinate length to consider the great varieties of the bath and their indications with any degree of detail. It must suffice to mention the chief of them, and but briefly. The *tepid*, *warm*, and *hot* baths are indicated by temperatures respectatively 85° to 92°, 92° to 98°, and 98° to 112° Fahr. The *cool* bath has a temperature from 60° to 75°, and the *cold* bath from 60° downward to the freezing point, Fahrenheit.

The ordinary domestic bath—the bath-tub—which has become a practical necessity to all cleanly people who can afford it, and common to domiciles and hotels, is chiefly defective because of the abominable, although almost universal, practice of placing it in the same room with the water-closet. Any one who indulges in the luxury of the morning cold bath,

the deep and invigorating respiration which it excites and the energetic friction which it prompts, soon acquires repugnance to all sources of impurity in the air of the bath-room. Pure air and plenty of it are conditions no less essential than an abundance of pure water. Hotels which do not provide an abundance of both pure water and pure air, and bathing facilities *ad libitum*, are unworthy of patronage; and "health" resorts without the bath are a misnomer.

Numerous devices have been contrived for increasing the efficiency of the bath, both for the promotion of health and the treatment of the sick, some of which are especially worthy of brief mention. For example:

The *vapor bath* is a favorite method of using warmth and moisture, and, on account of its effect in preventing evaporation from the surface, is a powerful agent for increasing bodily temperature. It can be borne at a much higher temperature than the water bath—from 120° to 150° Fahr. By preventing the evaporation of the natural moisture from the skin, and adding steam thereto, apparent profuse perspiration is the common and speedy result; but this is sometimes deceptive.

In some states of the system, when excessive perspiration is not easily excited, the condensation of the vapor on the skin is liable to be mistaken for it, and when this occurs the increased temperature of the body that results from such exposure is fraught with danger.

The *Turkish bath* consists of a succession of hot-air processes varying in temperature from 120° to upward of 200° Fahr., subsequent shampooing, and spray douche. With regard to its value, my personal observation fully justifies the remark that it is too apt to be overdone. Like the vapor bath, its object is profuse perspiration. Well persons are never benefited, and are sometimes injured, by subjecting themselves to the highest temperature common to the Turkish bath; and sick persons rarely or never need it.

It would be well for persons, particularly the debilitated, who resort to vapor and Turkish baths, to understand that, besides the danger of increasing the bodily temperature inordinately, the profuse perspiration which they excite is very exhausting; no less so than would be the loss of a pound or more of blood by venesection, or the cathartic effect of an ounce of Epsom salts: hence the lassitude which is commonly experienced after their use, and often misinterpreted by those who advise them as evidence of induced comfort.

On the whole, I believe such baths, indiscriminately used as they are, do more harm than good; they are much more of a test of physical endurance than of necessity, and should be discouraged except under competent advice.

Packing with the wet sheet, cold and hot, carries its description with the mention. By its means the stimulating action of the water is reduced to a minimum, and the refrigerating action only is the result. But it may here be remarked, with reference to the distinction which is insisted upon by some medical practitioners and writers upon the subject, that it makes

little or no difference whether the sheet used be wet with cold water or with hot, since the temperature of the skin and the sheet rapidly approximate, and the more rapid evaporation of the hot water speedily induces a degree of cold quite equal to that of the cold sheet, so that the choice might well be left to the fancy of the patient: the result is the same.

Sulphur baths, or, rather, *sulphur-vapor baths*, probably have no effect beyond that which would result from the vapor without the sulphur, whether applied as sulphur fumes or sulphuretted gases.

Mud baths are a nasty means of obtaining the results of a protracted warm bath—rarely indicated, and of doubtful benefit.

Of "medicated" baths in general, what has been said of the non-absorptive quality of the skin is sufficiently suggestive, except in so far as the medicines added to the water may be stimulating to the skin, as the salts in sea water and mineral waters, or by the addition of mustard.

Galvanic and *electro-magnetic baths* are deceptions. Whatever benefit is derived from their use is due to the magnetic and electric currents, if applied, wholly independent of the bath; it adds nothing to the potency.

The *douche* is a column of water poured from a height, which at one time was thought to be particularly adapted to the treatment of violent lunatics, probably because they were incapable of describing its severity. But since Esquirol himself submitted to it, and described the effect of a column twelve feet high falling upon his own head as resembling the continued breaking of a column of ice thereon, and the feeling of stupefaction which lasted for more than an hour afterward, few persons other than lunatics have used it.

The *shower bath* differs from the douche only in the division of the stream of water falling upon the head and shoulders; and the *needle bath* differs from the shower by its general application to the whole surface of the body by means of a perforated coil of pipe within which the bather stands.

The *rain bath* is simply a variety of the needle bath, the shower being from the top only, but inclined, and is that which it is the special purpose of this essay to describe, because it is deemed to be superior to all other devices for the benefit of the working-people and for the public schools, into which it should find speedy introduction.

Hitherto the *people's bath* has generally consisted of an enclosed swimming-bath along the dirty water-front of our cities, comprising the largest amount of physical exercise in conjunction with the bath—a condition of surf and sea-shore bathing of great benefit to those who commonly resort thither; but for the working-people, who have an abundance of exercise and particular need of the bath for cleanliness, no such provision for exercise is required.

For the introduction of the public *rain-bath* in this country, the people are indebted primarily to Dr. Simon Baruch, of New York. In an editorial article by him in the Philadelphia *Medical Times and Register*, August 24, 1889, after giving a brief review of the public bath in general, as

hitherto provided, he proceeds to give a description of the rain-bath as recently adopted in the German army and in several large German cities, in substance as follows :

These baths are simply arranged, built in the most economical yet substantial manner, and divided into spaces just large enough for an adult to stand and move comfortably in. The bather soaps himself, and turns on the cold or warm water, which falls upon him as a spray-douche; the mechanical action of which spray-douche, aided by his own efforts, rapidly cleanses the body, and the water flows away over the latticed floor into a receptacle which conveys it to the drain-pipes. The time, consumption of water, and attendance are thus reduced to a minimum; cleanliness of the bathing-room is rapidly obtained, and the danger of contagion, which would deter many from resorting to the tub baths, is entirely obviated.

Simple rain-baths of warm water and soap should be attached to our public schools, and the afternoon hours should be devoted to the task of cleansing the bodies of the little ones.

The warm rain-bath and soap would be a great boon to the poorer and laboring classes in mid-winter, when they rarely if ever have an opportunity, owing to the narrow limits of their dwellings, to cleanse their bodies. To the middle classes the cheapness of such a bath would commend itself.

The construction of a few such baths in our large cities would popularize bathing and protect the community against many diseases, without a large outlay of the people's money.

Only one month subsequent to that editorial Dr. Baruch read a paper at the Social Science meeting at Saratoga on the "Status of Water in Modern Medicine," comprising a plan for the construction of such a bath large enough to accommodate 8,000 bathers daily. And again, a little less than a year ago, at a meeting of the Section of Public Health and Hygiene of the New York Academy of Medicine, he still further elucidated the subject, and has continued to urge it, as he also did in the New York County Medical Society, with the happy result soon thereafter of seeing it adopted at the New York Juvenile Asylum, where Dr. Baruch is the attending physician; and more recently, on a larger scale, by the Association for Improving the Condition of the Poor.

Dr. Baruch has also been a pioneer in the adaptation of the bath to the treatment of disease, particularly in the treatment of typhoid fever. But a detail of it is not within the scope of this paper.

Since my visit to the Juvenile Asylum, a few weeks ago, the superintendent has kindly sent me a report, of which the following is an abstract:

"Instead of tumbling about in each other's soiled water, each child receives a clean shower of warm water upon his soaped body, the water at once flowing away. In the same plunge basin in which formerly 80 children were bathed per hour, now 280 are bathed." And from the report of the asylum for 1890, I extract the following: "The new bath,

which we have introduced on the suggestion of our attending physician, Dr. Simon Baruch, has proved quite satisfactory. It has four advantages: 1. It requires but a minute or two to prepare for bathing. 2. The children bathe in clean water. 3. A large number can bathe in successive companies. 4. It requires only one tenth to one fifth as much water as a plunge bath."

At the opening of the bath erected by the Association for Improving the Condition of the Poor, August 17th, 1891, John Paton, Esq., the president of the association, made the following remarks:

"The Association for Improving the Condition of the Poor is not merely a relief society, but it has ever in view the amelioration of the conditions, often unhealthful and uncomfortable, under which so large a proportion of the inhabitants of this city are compelled to live. It strives to better these conditions through its sanitary department, which is in constant communication with the board of health, receiving from the latter the most effective aid and coöperation. It also carries on a great work in sending fifteen hundred to two thousand people, chiefly mothers and children, weekly to its establishment on Coney Island, where they have fresh air, abundant food, sea bathing, and much innocent enjoyment.

"While New York is eminent for its admirable benevolent and charitable institutions so generously maintained by its wealthy citizens, for its public parks, for its abundance of pure water, and for its unequalled situation, it must be admitted that to have due regard to personal cleanliness is very difficult for the many who live in crowded tenements, where the only facility for bathing is an iron sink in the hall of each floor. Public baths are only available during the summer, the water being salt and far from pure.

"During the past few weeks I have been able to inspect the public baths in Great Britain, which are found in many large cities and towns upon an extensive scale. They are all erected and maintained by the rate-payers and vestries under an old Act of Parliament passed in 1846, which gives full powers to the local authorities. A uniform charge of twopence for a second-class and sixpence for a first-class warm bath is made, one penny being charged for a cake of soap. In connection with all the baths are extensive wash-houses, where women can bring clothes, etc., to wash, dry, and iron at a fixed charge of one penny per hour. Swimming-baths are generally attached and largely used, chiefly by young people. In no case did I find the baths self-supporting, the deficiency being met by taxation or assessment.

"Under these circumstances the New York Association for Improving the Condition of the Poor had resolved to try the experiment of erecting the People's baths, now thrown open, and capable of providing nearly one thousand baths daily. These are fitted up with every facility for bathing in comfort, and with all possible sanitary precautions. Following the plan so successfully tried in Vienna, most of the baths are supplied with warm showers or sprays, so that every impurity is immediately carried away and

any risk of infection is absolutely removed. For the same reason the towels will be steamed after use, and the cake of soap given to each bather will not again be used in the baths.

"The building has been erected upon a site kindly given by the New York City Mission, at a cost of nearly $25,000, exclusive of the land. Mr. J. C. Cady, the well known architect, drew the plans and supervised the work under the direction of Mr. William Gaston Hamilton, chairman of the association's baths committee. I think that all who inspect or use this establishment will say that it does credit to the taste and skill of these gentlemen.

"A charge of five cents will be made for each bath, including the use of a clean towel and a cake of soap; but tickets will be given on the most favorable terms to institutions, societies, churches, and donors to the association's funds, so that the advantages of the baths may be wide-spread and extended. With the kind coöperation of the city authorities and the chief of police, the most perfect order and decorum will be maintained; for while the People's baths are to be practically within the reach of all, yet women and children must ever be able to visit them with perfect comfort and confidence.

"In opening the People's baths we are making an experiment, and if it succeeds—as we hope it will—other establishments of the same kind will undoubtedly be erected throughout New York and other cities of the Union. Possibly it may be necessary to educate the people up to using these baths; but my friend Mr. Hamilton is prepared for this, and will even go to the length of adding a cup of hot coffee on a cold day, if needed as an inducement. Our friends of the medical profession have given the baths their strongest indorsement, and tell us that the effects upon the health of New York may be very marked in the future. '*Mens sana in corpore sano*' is harder to preserve where filth and impurity impregnate the atmosphere of our crowded city population, and such conditions affect the moral tone as well as the physical.

"That the People's baths may prove a great boon, leading many to see that cleanliness comes next to godliness, is our aim in this new but promising experiment."

I have personally inspected this bath—as, indeed, I have all the others in New York, as well those in process of construction as those already open for use—and observed its operation.

There are two entrances from the street, one for men and one for women, and these divisions are kept up throughout the building. Both sides are precisely alike. The entrance in each case leads into a light, airy reception- or waiting-room, finished in oak, with polished hard wood floors, and plenty of comfortable chairs and settees. A counter in one corner serves as a receptacle for towels and soap, and is presided over by an attendant.

To each applicant is given a long crash towel, thick and soft, and about two feet wide. With this goes a cake of soap, unscented, two inches long,

an inch and a half wide, and a quarter of an inch thick. The soap is encased in a paper bag, and the applicant is told to take it home.

Immediately in the rear of the reception-room and opening directly into it is the bath-room proper. Its roof is of glass, and of course the room is splendidly lighted. Each side of the large room is divided into nine bath-rooms, each of these being about eight feet long by five feet wide. Each room contains hooks for the clothes of the bather, and a rubber cloth to throw over them to keep them dry. At the end farthest from the door are hot and cold water faucets, and a large perforated brass ring through which the water descends in a rain-like shower upon the bather aslant. Fourteen of these rooms have no tubs. The floors are of slate, and there are stationary stools in each. The ironwork of which the partitions are made is painted white, and the walls of the main room are of white glazed tiling. Everything looks as clean and neat as a new pin. It is to this part of the building that the charge of five cents is made. There are seven rooms in the basement, just as clean but not quite as commodious as the others: these are free.

The front part of the building is two stories high, the second floor being occupied by the janitor and his family. The laundry, boiler-room, and furnaces are in the basement. The exterior of the building is handsome.

It is in the early Italian style, of light-colored brick and terra cotta, and stands out in strong contrast to its rather dingy surroundings.

As soon as the doors were thrown open for bathing, people began to come in crowds and present their nickels for a bath. There were, of course, at the outset, a good many boys, but men and women of the working classes predominate. Mechanics take their wives and children; whole families go and stay the allotted twenty minutes, and emerge looking fresh and clean. The largest number who had used the bath in any one day, up to the time of my visit, October 1st, the superintendent informed me, was 661. The bath is open fifteen hours daily.

For the rest, I have been kindly furnished the following condensed description by Mr. William Paul Gerhard, consulting engineer for Sanitary Works in New York city, and member of the American Public Health Association. Mr. Gerhard, associated with Messrs. Brunner & Tryon, architects, of New York city, prepared the plans and specifications for the rain-baths at the Demilt Dispensary, at the Hebrew Institute, and for the Baron de Hirsch Fund Baths, and the work was in all cases carried out under his personal superintendence.

I. *Demilt Dispensary.*—In this dispensary, located at the north-west corner of Second avenue and Twenty-third street, the baths are located in the basement.

There are six rain-baths and one tub-bath—the latter for invalids and for children. Provision has, however, been made for the future fitting up of six or more additional baths.

The baths are used by men and women on alternating days of the week.

Each bath consists of two compartments, the dressing-room and the bath proper. Each compartment is about $3\frac{1}{2}$ feet square. The dressing room has wooden partitions, and wooden lattice doors about 7 feet 3 inches high, while the bath proper has walls lined with $1\frac{1}{4}$ inch blue-veined Italian marble slabs. The floor of both compartments is concreted. The bath-room proper has a depression of about 6 inches in the floor, with a metal strainer over the waste-pipe. Each bath has also a large overflow pipe and strainer placed in the side of the depression at a suitable height, and the openings of the strainer are so graduated that while the water flows off, it does not flow out as fast as delivered by the douche; consequently there are always a few inches of water in the bottom of the trough, so that the bather's feet stand immersed in water.

The water is delivered by an inclined rain-douche standing at a height of about $6\frac{1}{2}$ feet from the floor, and under such an angle that the "rain" will not strike above the neck of the bather. The flow of water is under control of a janitor. As soon as the bather is undressed he steps into the bath compartment, and announces, by an electric bell, that he wishes the water turned on. The janitor goes to the valve-board in the waiting-room, notices the number of the bath on the annunciator, opens the respective cold and hot water valve, and allows the water to mix in the mixing chamber. The temperature of the mixture is indicated on a hot-water thermometer, of which there are as many as there are mixing chambers, viz., six. As soon as the water has been brought to the right temperature, the janitor opens the valve controlling the douche. When the bather has finished he rings the bell once more, and the water is again shut off.

Each bather receives a piece of soap and a towel. The charge for bath, soap, and towel is ten cents, but persons who cannot afford to pay this sum can have a bath without charge.

It was first contemplated to heat the water with steam in a Tobey hot-water heater, but no steam being available for this purpose, a Boynton hot-water heater was put up in the basement with a 200-gallon tank as a reservoir for hot water. All water pipes are of galvanized wrought-iron pipe, and the douches are of copper.

The separate bath-tub is used by invalids and by mothers bringing children with them. It is an enamelled, rolled edge iron bath, standing on legs, raised 14 inches high, so as to be at a convenient height to bathe children. The outside of tub, as well as all wooden partitions, is painted with Aspinwall's special bath enamel.

The plumbing work pertaining to the baths is carried out in strict accordance with the New York Board of Health regulations. Each bath is trapped separately, and all the traps are amply ventilated.

Water is obtained by meter measurement through a 1-inch tap in street main, and a 2-inch galvanized wrought-iron service-pipe.

The lighting is done by gas, and the heating by the hot-water heater and some steam pipes.

Mr. Gerhard carried out the following experiments by meter measurement of the quantity of water used in these baths:

The bath-tub, which is 5½ feet long and 24 inches wide, required, when filled to within 5 inches of the overflow, about 6 cubic feet, or 45 U. S. gallons of water. With both faucets running, it took about two minutes to fill the bath-tub. Pressure of water estimated at about 20 pounds per square inch. The douche bath, on the other hand, with both hot and cold water valves about half open, delivered 4.75 cubic feet in five minutes, or 35.625 U. S. gallons in five minutes, or 7.125 gallons per minute. Allowing three minutes as an average time for shower running for each bather, the water consumption in the douche bath would be about 21.375 U. S. gallons. In other words, the proportion between water used in ordinary bath-tub and water used for douche bath would be as 45 to 21.375, or more than twice as much for the bath-tub.

II. *Hebrew Institute.*—This is a newly completed building, designed by Messrs. Brunner & Tryon, architects, and located at the intersection of Jefferson street and East Broadway, in the eastern portion of the lower part of New York city. It is intended for purposes similar to those of the Cooper Institute, and contains a large assembly-room, with stage, class-rooms, a reading-room and library, a workshop, gymnasium, and shower-baths.

These latter are located on the top floor, and there are in all five shower-baths. The floor is made of artificial stone (flintolithic pavement), and is raised one step above the general floor level.

The bath compartments are very roomy, each measuring about 4 x 5 feet. The walls are lined to a height of 6 feet with blue-veined Italian marble slabs. There are in front of each bath a cloth curtain to prevent splashing, and a light lattice door of wood. In this compartment the bathing under the douche is done; the undressing and dressing is done in an adjoining large room with lockers. The douches and pipes are of nickel-plated brass. Each douche stands at the proper angle of inclination at a height of about 6½ feet from the floor, and each douche is controlled by a self-closing cock with chain and pull attached. The bather turns on the cold water himself, and tempers it to the desired temperature by turning on the hot water. Each mixing chamber has a thermometer attached. While bathing, the chain and pull are hooked up so as to leave both hands of the bather free. The water is supplied from two large tanks located on the roof of the building.

Hot water is obtained from a Tobey hot-water heater located in the basement, and heated by steam from the heating boilers. This heater differs from ordinary hot-water tanks in having an automatic steam shut-off, operated by means of an adjustable expansion rod in the top of the heater. This heater is very economical in the use of steam, for when no hot water is drawn the steam valve closes automatically. A lock-nut and screw on the end of the expansion-rod can be so set and regulated as to open the steam valve much or little, as may be desired, and thus the desired temperature of the hot water can be regulated at the heater—that is,

the heater can be adjusted to give hot water of any desired temperature (within certain limits). Overheating of the water may thus be prevented, and there is consequently no danger of scalding a person by hot water. The heater is the invention of Dr. Tobey, until quite recently the medical superintendent of the Toledo State Insane Asylum.

The rooms are lighted by both electric incandescent light and gas. Heating is by direct steam radiators. Ventilating registers are set in the walls, connecting with large outlet flues. All plumbing relating to the baths is arranged in conformity with the rules of the New York Board of Health.

III. *Baron de Hirsch Fund Baths.*—The first baths, erected by the trustees of the Baron de Hirsch Fund, are located in a corner building at the intersection of Henry and Market streets, in the eastern end of lower New York city. A basement and street floor have been rented in a flat or apartment-house, and the place transformed into a bath-house after plans and specifications prepared by Mr. Gerhard, assisted by Messrs. Brunner & Tryon as consulting architects.

The street floor is intended for women and the basement for men.

Provision is made for fifteen douche baths for men and fifteen similar baths for women; but of these there have been for the present put up nine baths for men and eleven baths for women. Besides the douche baths, the street floor contains one bath-tub for invalids' and children's use, two water-closets, one slop sink, and one drinking-trough. The basement contains one drinking-trough, one slop sink, a water-closet and a urinal, two hot-water heaters, and a large hot-water tank. Each floor contains a small office, with railing, desk, and chair, where the tickets are sold. Baths for adults, with soap and towel, will cost five cents; and for each child a charge of two cents is made.

The floor is made throughout of artificial cement stone, and all the douche baths have depressed basins moulded in cement for the bather to stand in. The arrangement of each bath is similar to that in the Demilt Dispensary, except that for all partitions and divisions, galvanized corrugated iron is used instead of wood or marble. This galvanized corrugated iron is fastened to angle and T irons, and all iron-work is painted with five coats of special bath enamel, white color. Each bath compartment contains, besides the rain douche, a soap-cup and a hook to fasten the pull of the self-closing bib. Each dressing compartment contains a hard-wood seat and six enamelled iron clothes-hooks. The dimensions of each bath are approximately eight feet deep by four feet wide, and the bath proper is 3½ to 4 feet deep and 4 feet wide.

Water is obtained by direct street pressure through a 1-inch tap and 2-inch galvanized wrought-iron service pipe, on which a 2-inch Thomson water meter is placed.

In these baths hot water is generated in two Hitchings hot-water heaters, and it is stored in a 400-gallon galvanized hot-water tank. From here the hot water is carried to a large mixing chamber of 30 gallons' capacity,

and the cold water is also carried to same, and the two are mixed here by the bath attendant or janitor to the desired temperature, which is indicated by a special hot-water thermometer. The tempered water is carried to the douches at each bath, so that the bather cannot control the temperature personally. On the other hand, he can, by means of the self-closing bib controlling the douche, open the latter and allow it to run when and as long as he pleases. This arrangement was adopted to obviate the necessity of having a large number of electric bells. All water pipes are of galvanized wrought iron, and the douches are of copper, of special construction and shape.

Cold water is supplied directly to the drinking-troughs, water-closets, and the urinal, also to hose-bibs for washing the entire floor. Both hot and cold water are supplied to the slop-sinks and to the ordinary bath-tub for children's use.

On each floor there are two floor cesspools to remove water from floor washing.

The best sanitary fixtures and appliances are used throughout—porcelain hopper closets, with flush operated automatically by seat action; porcelain urinal with intermittent automatic flush; porcelain glazed rim slop-sinks; and porcelain drinking-troughs. The bath is of enamelled iron, with glazed rolled edge, and stands on high legs. All walls, iron-work, pipes, the slop-sinks and the tub, etc., are painted with five coats of white bath enamel paint.

All the plumbing conforms to the New York Board of Health regulations.

The rooms are lighted with gas (electric light not being available in the district), and the heating is done by means of direct hot-water radiation. Efficient ventilation is provided by means of a large 16 × 24-inch galvanized-iron flue, inside of which the 11-inch round smoke-pipe from the heaters is carried to the top of the roof of the building. From this flue branch vent ducts are carried to each floor.

XXI.

CONSIDERATIONS UPON THE ENDEMICAL CHARACTER OF YELLOW-FEVER UPON THE COAST OF THE GULF OF MEXICO.

By GREGORIO MENDIZABAL, M. D.,

Vera Cruz, Mexico.

Mr. Chairman and Gentlemen: To-day, more than ever, I feel sorry to be unable to speak the language of Shakespeare and Lord Byron; not only because it would be more energetic and laconic, more rich, more flexible, and more expressive than ours—the sweet and sonorous language of the author of the immortal Don Quixote—but that I might avail myself of the correct and proper words in expressing my views, in order to be understood by those who do not understand the Spanish language; and, principally, because the majority of this audience speaks but English, and I am obliged to address myself chiefly to said majority in order to tender my thanks for the honorable invitation made to the Supreme Board of Health of the city of Mexico to send its delegates to the meeting of this interesting Association. I wish I could speak in plain English—in the same sententious language through which that colossus of the tribune, the eminent Daniel Webster, expressed his delightful and immortal thoughts!

I would express my ideas in that same language in which was written the first act of independence on the free American continent; the language in which were issued the wise proclamations of the great George Washington; the language of Bancroft, Logan, Everett, and the sweet Longfellow; the language, finally, that the wise Franklin used when strong emotion made the tears to flow as he felt the electrical convulsion of his kite, understanding, in that historic moment, that he had stolen from nature one of her most precious and important secrets!

I should be very happy, indeed, in using the same language used by Morse when he sent that first telegraphic message which so astonished the whole world; the language of Edison, the wizard of our times, in which he wrote in the Eiffel tower at Paris this word only,—God—severe lesson given by the young and enterprising America to the old and mercenary Europe! Here, in this centre of industrial wonders, in this land of prosperity, I should be the happiest of men if I could say what I feel and think,—the impressions reflected on my soul, and the success we have witnessed in regard to the eminent progress realized in this country, in the closing of the nineteenth century, with strong reason named the cen-

tury of light, not only for the illumination thrown on every branch of human knowledge, but chiefly because it has overcome the darkness of night: not being satisfied with having conquered time and space, it has invented the electric light, the salvation of the navigator, and the pleasure of ourselves. By night we challenge the darkness with our splendid foci that have the softness of the moon, the brightness of the sun, and the sweetness of Sirius and of Canopus,—forming that new constellation of stars of human make which adorn our streets and squares.

Our century, that is so great in the history of mankind, has solved the most difficult problems; has given an impulse to the arts, to commerce, and to industry in general far beyond the possibilities of a century ago; and, like a crown for its works, gives special attention to the conveniences of life, to those things which tend to make life easier and more tolerable, giving to public health the importance that was granted before to political affairs, and writing on its glorious banners, as its motto, *Salus populi suprema lex esto*, which was a sarcasm on the lips of the corrupting and at the same time corrupt Roman empire. The century that made the whole world to wonder with its gas and electricity will put a golden clasp to its weighty accomplishments *in folio* by sending to the Old World an immense quantity of power, by transforming into electricity and accumulating the wonderful force of the Niagara falls, that of the high tide, and of all the forces of nature.

The medical century, that began by teaching that tuberculosis was incurable, will end by showing us how to cure it and how to destroy its germs, and, perhaps, even to prevent it; will leave history to tell of the great epidemics that will be prevented by hygienical means; and the century of surgery, that has witnessed so great a number of deaths from operations, will finish by extirpating larynxes and doing fine operations after the teachings of Pasteur and Lister.

The beginning of this century saw the Mexican people tied with the chains of slavery, but they were soon broken, proclaiming the evangelical equality of human beings, and slavery was abolished in the year 1810.

Because of these things I accepted my appointment, and I will now proceed to treat the matter upon which I wish to make a few remarks.

Mr. Chairman and Gentlemen, it is a great pleasure for me to address an association composed of so many illustrious persons, being a delegate, as I am, of the important state of Vera Cruz, in the Republic of Mexico. As my appointment was made but a very few days ago, I have not had time to prepare a work that would be worthy of your honorable attention; nevertheless, I have written a paper which I will deliver to the secretary in order to receive your judgment, and presently I will try to express in a few words my ideas in reference to one of the most dreadful diseases,—the disease that causes so many deaths along the coasts of the Mexican gulf, and especially in the port of Vera Cruz.

Doubtless you understand that this disease is the yellow-fever, about which so much has been written, and about which, notwithstanding, so much is unknown. I want to controvert some erroneous ideas, very common indeed, in regard to the history and geography of this disease, ideas, too, that have been accepted by the scientific world. In a few words, also, I will tell you something about the epidemics that very often occur in the city of Cordova in the state of Vera Cruz, and in regard to the treatment we employed in the year 1881 with complete success; and I will end with some considerations in regard to the advantages that a change of ideas may produce, about the nature and germs of the yellow-fever; because, demonstrating that some places are not, against the general belief, *amarilogenus*, or procreators of yellow-fever, it is easy to devise ways of restraining the transportation of germs from one place to another; and perhaps, with stringent health laws, we may be able to destroy forever such diseases, contributing thus to the progress of certain places, at present justly dreaded.

It does seem trivial to treat of such questions in regard to the history of any disease, but the truth is that such study is of great importance; and when that disease has the name of yellow-fever, I truly believe that this honorable Association will agree with me that any study in regard to the history of that disease is useful and eminently humanitarian. Studying the peculiarities of its first appearance, and the analysis of its invasions in different countries, it is possible to obtain very interesting data, not only to enrich the epidemiology, but the pathogeny, of this fever.

Reading the latest works on this disease, we must conclude that nothing definite has been determined in regard to the time at which it first appeared. Some think that before the discovery of the New World the yellow-fever had run over the Eastern continent; others profess the opinion that it appeared when the young America came into the civilization of the Old World. Some believe that the yellow-fever has not an American source, but was imported either by the Europeans or by the negroes; and others think that the disease existed already when Christopher Columbus discovered America, and that it had visited many places in the West Indies and on the southern coasts of America. Each one claims to have written the last word about it, but I have to confess sincerely that I am not satisfied at all to conclude that the yellow-fever existed before the discovery of America, because none of the documents presented are sufficiently clear to settle conclusively such a question.

The followers of this opinion have essentially for a basis the notable work of Dr. Cortes Finlay, presented in the year 1884 to the congress of Americans, at Nancy, France. This work bears the title, "Notes on the Primitive History of the Yellow-Fever: Havana, 1884." I have read this work many times, and I fail to find in it any details on which to base the conclusion of the preëxistence of this disease; while, on the other hand, there are strong proofs that the name of *Cocolixtle* was applied by the Mexicans to the malaria, chills, and fever with which the Europeans

were afflicted when they began to remove the ground to build their first churches and palaces.

If the other arguments are as vague as these, on which rest this opinion, and that of Raymond, Breton, and Dutertre on the *Policauntinae* of the Caribbees, and the opinion of Webster in regard to the epidemics that caused so great a mortality on the southern coasts of North America from the hottest lands as far north as Massachusetts, we must conclude that these opinions have not any basis; and, therefore, it is rational to say that it is not proven at all that yellow-fever existed in Mexico when Columbus discovered the new world.

Geography of the Yellow-Fever:—Holding a pencil and a geographical map, it is very easy indeed to demonstrate mathematically the field of action of the yellow-fever. Moreover, with the statistical data, since that illness first appeared until it came under the control of science, we can certainly define the zone where it develops endemically, and mark the progress and extent of its invasions on places not naturally subject to it. There is an interesting chart made by Lombard, of Ginebre, and by referring to it and to his able works on medical geography we can see clearly that of all the zymotic diseases the yellow-fever is the one that has extended itself less than any other of the same character, and that, with few exceptions, it is localized in the tropical portions of the Atlantic coast. From time to time it does make some incursions into the temperate regions, but very seldom extends its dreadful action to the Pacific coast.

This action, then, is localized in the inter-American shores of the Caribbean sea, in that great space of somewhat semi-circular form that begins with the coast of Florida in North America, and, following the shores and courses of the rivers, runs over the states of Alabama, Louisiana, and Texas in the United States, and in all the length of the Mexican coast as far as Yucatan, going thence to Honduras, Guatemala, New Granada, and Venezuela, and thence to the Antilles or West Indies.

From this circle, which we can consider as the centre of action of the yellow-fever, the disease has very often extended its action in every direction, according to commercial intercourse.

People believed during the past century that the action of the yellow-fever never could extend beyond 33° north latitude and 25° south. In the year 1817 the Faculty of Medicine of Paris declared 48° north latitude as the limit of yellow-fever; and yet, a few months later, yellow-fever desolated Swansea located at 51° north latitude, Quebec at 48°30′, and Halifax at 44°2′. The same fever has visited Boston a dozen times, New York a score, and, descending to Brazil, touched Buenos Ayres situated at 34°54′ south latitude; and finally the epidemic reached El Callao and Lima, passing through Cabo de Harnos. On the western coast of South America the mortality by yellow-fever has extended more than once as far as Copiapó and Valparaiso, Chili, to wit, to 40° south latitude. On the western coast of Africa the yellow-fever had, up to date,

reached 10° south latitude, Saint Paul de Loanda; but the eastern coasts of Africa were long ago under the control of the fever.

There can be no possible discussion on such matters, because they are facts of observation that have destroyed all kinds of theories, and at the same time have demonstrated that the invasions of yellow-fever are capricious and unexpected; and, what is worse, man cannot control it because he does not know its essence, its sources, and so cures it empirically, trusting more in its similarity with some previous cases than to science. But whence comes the germ of the yellow-fever? which the place where it was developed? Some one says Vera Cruz; some other, Havana, or San Domingo; and there are, too, those who believe that the procreative germ was born in the states of Louisiana, Texas, South Carolina, and Alabama in this country; and, of course, some others who profess belief in the procreation of the germs in Brazil, or on the African coasts.

I certainly do not believe that Vera Cruz and the Mexican coasts of the gulf are *amarilogenus* places. There are the statistical data of Humboldt, from 1767 to 1774 and from 1776 to 1794, in which there is not a single case of yellow-fever in the port of Vera Cruz mentioned.

The statistical data by Bouffier, embracing a period of fifty-seven years, show that in nine years there was not a case of yellow-fever in Vera Cruz.

Recently (from 1884 to 1890) there has not been a single case, and this is the more notable because in this later period the influx of foreigners has been of great importance, nearly 8,000 people from other regions being at Vera Cruz alone, and, therefore, in the best conditions to procreate or to develop the yellow-fever germs. The summers have been very hot, the rainy seasons long and abundant; and yet, with such favorable conditions for the germs, we have had no developments.

If Vera Cruz were, as stated by Beranger-Ferran, a procreator of germs of yellow-fever, why have we had such periods without the disease? During the last winter we had a little epidemic (imported from Havana), a passenger landing at Vera Cruz already sick; but the epidemic was so mild that less than twenty per cent. of patients died, and of those ten per cent. were foreigners. These imported cases occur very often, and have been observed and studied by our physicians.

My opinion is, that Vera Cruz offers a propitious field for the multiplication of germs, and that there is something in its hydro-telluric conditions that gives life to the germs; but, if we try to combat those conditions, and to prevent in any way the importation of the disease, we could, as you have done in New Orleans and New York, put a stop to new invasions, and thus avoid the epidemics forever. If the disease has often assumed in Vera Cruz an endemic character, it is due, not to the yearly procreation of new germs, but to the fact that the germs dislike the cold weather and absent themselves until summer appears; therefore it is logical to conclude that these epidemics can be avoided by hygienical resources, and it is proved that when these have been resorted to the fever has disappeared. Such was the case in the year 1863, when the city water-works were com-

pleted; it disappeared again when the walls of the city were demolished. But when the excavations were made, or, in other words, when the germs were set free, the yellow-fever appeared. For instance: Some few years ago, when some vaults in the cemetery, in which were interred people who had died of yellow-fever, fell down, an epidemic occurred in the city.

For these reasons (among very many others that I wish I had time to express) I do believe that Vera Cruz is not a procreator of yellow-fever germs, and I hope that time, medical observation, and hygienical means will prove the truth of my opinions.

Near to Vera Cruz is the city of Cordova, seventy-five miles from the port. Cordova is about 2,700 feet above the sea level, and the temperature is very mild. The vegetation—bananas of very many different kinds, coffee, tobacco, and many vegetables—is luxuriant. The health conditions of the city have a very good reputation; yet from time to time (every eight or ten years) the yellow-fever invades Cordova as an importation from Vera Cruz, but never remains there, because the winter kills the germs of infection, and the same coldness prevents procreation. There is no difference in regard to the persons that become sick. The natives and the foreigners, the poor and the rich, are all afflicted with the disease, imported, as I said before, from Vera Cruz. But it is a notable fact that Orizabo, the city in which I practise, situated at a very short distance from Cordova, never has had the yellow-fever. Is that on account of the fact that Cordova has very poor water, and that Orizaba—which means joyful waters—has abundant and wholesome springs? Not only that, but Cordova is built on clayish ground, which, as is well known, is well fitted for the procreation of any kind of germs because it retains the water, and the clay, the mud, and the water are enough to develop the life of germs, particularly when in that water it is easy to find fleshy matters in process of decomposition; and those are the matters which produce the tyrosine, the leucin, the greasy acids, and particularly the ptomaines, which, as you know, are very propitious for the development of all kinds of infectious diseases.

From these facts which I have stated, and from other observations that have been made, I conclude that Cordova, like Vera Cruz, is a propitious field for the development of germs, but is not able to produce them for herself.

During the last epidemic at Cordova (ten years ago), I remember two patients who were in a very bad condition that threatened to end fatally, and who were cured by me with hypodermical injections of phenic acid,—one per cent.; and I had a complete success. Since that epidemic I have had no further opportunities to observe the effects of this treatment, but at least my success in those cases gives me confidence for further trials, which will thus provide an opportunity to judge better of the effects of the phenical treatment.

XXII.

HEIGHTS AND WEIGHTS OF CHILDREN.

By Supt. J. M. GREENWOOD,

Kansas City, Mo.

My attention was first directed to physical statistics by the unchallenged statement, often reiterated by various authorities, that the Americans, as a nation, are rapidly deteriorating in those physical qualities which characterize a vigorous, robust, healthy people. The underlying principles in our civilization were assumed to be of such a nature as to sap the vital powers of the people, and to leave a residue of nerves and ganglionic centres, minus bones and flesh. To prove or to disprove a general statement, based upon a mere assumption, oftentimes involves so many different factors as to preclude, practically, anything like a positive demonstration; yet enough data may be collected to show the general trend of the resultant forces, and from these, at least, some inferences are allowable. From what is herewith submitted, it will be seen that no account of individuals, but of groups, was taken. Should a complete investigation be undertaken, a record of each individual should be kept, covering the entire school-life as well as the number of studies pursued each year. Yet these facts could not be made to reveal the home regimen, an equally important factor. Food, clothing, labor, rest, and sleep are important factors on the physical side of existence, as is shown by the statistics of mean averages, resulting from the occupations of the parents whose children have been weighed and measured.

During the school-year of 1886, I decided to measure and weigh some of the pupils attending the public schools of Kansas City. The pupils were measured with boots and shoes off, and weighed without their wraps. In collecting and tabulating the statistics of 1886, and again those of 1890, I had very little information at my command to guide me. Mulhall, in 1884, had published in his Dictionary of Statistics some fragmentary information, which I employed as a basis of comparison. Since tabulating the statistics of 1890, I have had access to Parts 1 and 2, Dictionary of Statistics, by Michael G. Mulhall, London, 1891, and in which considerable information on anthropometry is tabulated from various sources.

It will be observed that the tables embrace children from ten years to eighteen years of age; also, colored children were included, and tabulated separately. This is the only instance, as far as I am aware, that any record has been made of persons of African descent.

PUPILS OF KANSAS CITY PUBLIC SCHOOLS.

Statistics Collected in 1886.—White.

No.	Age.	Aver. Height.	Aver. Weight.
80 girls,	10	51.5	63.9
75 "	11	53.2	70.5
83 "	12	55.4	78.2
54 "	13	57.2	90.1
46 "	14	59.2	101.2
45 "	15	61.8	107.2
60 boys,	10	52.3	66.35
70 "	11	53.3	73.2
70 "	12	55.4	81.35
76 "	13	56.3	87.2
57 "	14	58.5	92.2
27 "	15	62.8	107.3

Statistics Collected in 1890.—White.

No.	Age.	Aver. Height.	Aver. Weight.
400 girls,	10	51.68	65.92
411 "	11	52.7	66.2
469 "	12	54.015	80.64
311 "	13	57.43	91.72
366 "	14	60.31	100.1
313 "	15	62.04	109.36
186 "	16	62.52	111.16
87 "	17	62.9	117.11
52 "	18	63.29	118.92
24 "	19	64.2	120.25
349 boys,	10	52.	67.5
395 "	11	53.	70.96
408 "	12	56.	78.28
293 "	13	56.6	87.45
347 "	14	58.6	93.45
133 "	15	62.4	111.27
129 "	16	63.93	119.
77 "	17	64.8	126.6
24 "	18	66.66	136.83

Statistics Collected in 1890.—Foreign.

No.	Age.	Aver. Height.	Aver. Weight.
54 girls,	10	50.5	63.77
69 "	11	52.8	70.58
39 "	13	56.56	86.66

No.	Age.	Aver. Height.	Aver. Weight.
34 girls.	14	60.23	100.
9 "	15	62.11	104.77
12 "	16	62.58	110.16
48 boys,	11	53.98	76.75
62 "	12	54.77	77.48
28 "	14	58.6	91.46
17 "	15	59.05	106.11
12 "	16	62.41	107.

Statistics Collected in 1886.—Colored.

No.	Age.	Aver. Height.	Aver. Weight.
23 girls,	10	51.6	64.2
24 "	11	53.5	79.
26 "	12	55.5	90.
22 "	13	57.	99.
25 "	14	59.1	101.6
14 "	15	60.6	107.3
11 boys,	10	50.2	68.7
11 "	11	50.6	71.5
14 "	12	54.	87.5
19 "	13	55.7	92.4
21 "	14	57.8	98.3
13 "	15	62.1	109.8

Statistics Collected in 1890.—Colored.

No.	Age.	Aver. Height.	Aver. Weight.
30 girls,	10	49.8	74.56
52 "	11	52.8	79.85
61 "	12	54.	82.83
62 "	13	56.85	97.145
44 "	14	58.75	103.83
46 "	15	61.54	110.13
32 "	16	62.8	117.
12 "	17	66.	128.
28 boys,	10	51.	72.7
36 "	11	53.36	78.25
44 "	12	53.73	83.
51 "	13	56.	89.
29 "	14	58.88	93.55
33 "	15	61.	112.3
9 "	16	64.44	121.1
5 "	17	65.	130.

FROM MULHALL'S DICTIONARY OF 1891.

Age.	Height in inches.				Weight in pounds.			
	English.	American.	Belgian.		English.	American.	Belgian.	
	Male.	Male.	Male.	Female.	Male.	Male.	Male.	Female.
10	51.8	51.7	50.1	49.2	67	66	56	51
15	62.2	62.3	59.6	58.6	103	105	91	88
20	67.5	67.4	65.8	62.0	143	147	131	117
24	67.7	67.9	66.2	62.1	148	147	146	123
30	67.9	68.1	66.4	62.2	152	150	146	122

Height is without shoes, but weight includes clothing.

HEIGHT OF CHILDREN IN VARIOUS COUNTRIES.

(INCHES.)

Age.	Manchester. Crowell. 1860.		Brussels. Quetelet. 1870.		Boston. Bowditch. 1877.		Turin. Pagliam. 1876.		Bordeaux. Leyet. 1882.		Average.	
	Boys.	Girls.	Boys.	Girls.	Boys.	Girls.	Boys.	Girls.	Boys.	Girls.	Boys.	Girls.
10	50.5	49.5	50.0	49.2	51.7	51.3	49.7	50.1	50.9	50.9	50.5	50.2
11	51.3	51.7	52.5	51.3	53.2	53.6	51.3	52.1	52.1	52.9	52.1	52.3
12	53.2	53.6	54.4	53.2	55.2	56.0	53.6	54.0	54.8	55.2	54.2	54.4
13	54.8	55.6	56.0	55.2	57.6	58.8	55.2	56 4	56.4	58.0	56.0	56.8
14	56.7	57.9	58.0	57.2	59.9	60.3	57.2	59.2	58.0	60.4	58.0	59.0
15	59.1	58.7	59.5	58.7	62.2	61.0	59.9	60.3	....	....	60.2	59.7
16	62.2	59.5	61.1	59.9	65.0	61.4	62.2	60.6	....	....	62.6	60.3
17	63.8	60.7	62.6	61.1	66.2	61.8	63.0	61.0	....	....	63.9	61.2

COMPARISONS.

The yearly increase in weight of the native white girls, from 10 years to 15 years of age, in 1886, was 6.6, 7.7, 11.16 pounds; in 1890, from 10 to 19 years of age, was .28, 14.44, 9.08, 8.38, 9.26, 1.8, 3.95, 1.81, 1.33.

Of the boys in 1886, of corresponding ages, was 6.85, 8.15, 5.85, 5, 15.1; in 1890 was 3.46, 7.32, 9.17, 6, 17.82, 7.73, 10.23.

Of the foreign girls in 1890 from 10 to 11 years, 6.81 pounds; from 13 to 14 years, 13.33 pounds; from 14 to 15 years, 4.77 pounds; and from 15 to 16 years, 3.39 pounds.

The foreign boys from 11 to 12 years, .73 pounds; from 14 to 15 years, 14.65 pounds; and from 15 to 16 years, .89 pounds.

The yearly increase in the average weight of the colored girls, from 10 years to 15 years of age, in 1886, was 14.8, 11, 9, 2.6, 5.7 pounds; and for the colored boys 2.8, 16, 4.9, 5.9, 11.5 pounds; for 1890 the colored girls, 10 years to 17 years of age, 5.29, 2.98, 4.75, 6, 4.55, 8.75, 8.8, 9.9 pounds.

In the *Journal of the American Medical Association*, Chicago, January 3, 1891, it is stated that Dr. Bowditch of Boston made 14,000 examinations of boys, and 11,000 of girls, between the ages of 5 and 16: The yearly increase in the weight of the boys, 4, 4, 5, 5, 6, 7, 8, 10, 12, 14 pounds; of the girls, 3.5, 4, 4.5, 5, 5, 6.5, 9.5, 10.5, 10, 7.5, 6 pounds.

The yearly increase in the height of the white girls of Kansas City in 1886 was 1.7, 2.2, 1.8, 2, 2.6 inches; and in 1890, 1.01, 1.285, 3.415, 2.9, 1.73, .48, .38, .39 inches. Of the white boys in 1886, 1, 2.1, 1.1, 2.2, 4.3 inches; and in 1890, 1, 3, .6, 2.6, 3.8, .6, .87, 2.66 inches.

The yearly increase in the height of the colored girls in 1886 was 1.9, 2, 1.5, 2.1, 1.5; and in 1890, 3, 1.2, 2.85, 1.9, 2.79, 1.26, 3.2 inches. Of the colored boys, 3.4, 1.7, 2.1, 4.3; and in 1890, 2.36, .37, 2.27, 2.88, 2.12, 3.44, 1.56 inches.

Mulhall gives the yearly increase in height and weight of English boys from 10 years to 20 years of age as follows: 1.5, 2.1, 1.8, 2.2, 2.3, 2.6, 1.6, .4, .3, .5 inches; 4.8, 6.2, 6.7, 10.6, 12.2, 15.2, 12.2, 4.8, 2, 3.9 pounds.

COLOR OF THE EYES AND HAIR OF THE PUPILS EXAMINED IN 1890.

Girls—Color of Eyes: Brown, 783; blue, 1,121; gray, 517; black, 177, hazel, 17—total, 2,615.

Girls—Color of Hair: Brown, 1,790; light, 502; black, 281; red, 42—total, 2,615.

Boys—Color of Eyes: Brown, 636; blue, 887; gray, 471; black, 144; hazel, 17—total, 2,155.

Boys—Color of Hair: Brown, 1,241; light, 473; black, 368; red, 73—total, 2,155.

Foreign Girls—Color of Eyes: Brown, 78; blue, 79; gray, 42; black, 18—total, 271.

Foreign Girls—Color of Hair: Brown, 128; black, 23; light, 63, red, 3—total, 217.

Foreign Boys—Color of Eyes: Brown, 47; blue, 61; gray, 36; black, 23—total, 167..

Foreign Boys—Color of Hair: Brown, 104; black, 26; light, 32; red, 5—total, 167.

The examinations show that at ten there is little difference between the height and weight of boys and girls, and between 11 and 12 the girls grow more rapidly, usually, than the boys till 14 or 15, and then the boys go ahead again. Graphic illustrations accompanying the tables will give a much clearer idea of the relative growth of the sexes in this city than any extended verbal description.

It is, however, from an educational stand-point that these statistics are most suggestive. From observation it is a well authenticated fact that there are periods in every child's life when the growth in height and weight is the greatest. These periods may not be synchronous. When the boy or girl is growing the most rapidly, the vital functions are the most active in making accumulations for the future wants of the body. At this period the intellectual, educational stress upon the system should be the least possible. Consequently, the rapidly growing child, as a physical being, should not be pushed too severely in his studies. This is the very age at which both teacher and parent are most likely to find fault with the child, owing to a superabundance of inertia. Excessive study, over-strain in late hours, and loss of sleep at this critical stage, will sap the foundations of the most vigorous constitutions, and lay those germs of future weakness which too often render life one long-drawn-out wail.

In no manner should the natural, healthy growth of children be retarded by excessive physical or mental labor, innutritious food, impure air, deficient clothing, or insufficient sleep.

Another thing which merits attention is this: Girls, especially those in high school, learn more rapidly than boys; they stand usually much higher in their classes. This is doubtless owing to the fact that they cease to grow more rapidly at an earlier age than boys, and their systems have attained, as it were, a higher degree of solidity than the boys of corresponding ages. In this case the physical facts help explain the mental differences. Two important educational questions naturally arise at this juncture:

1. What effect has physical growth on the pupil's intellectual faculties?

2. Because girls mature earlier in life than boys, is this the reason they reach a higher degree of excellence in scholarship than the boys classed with them in the high schools and colleges?

From the statistics thus far published by Mr. Mulhall in 1891, it does not appear that the men of the United States are inferior physically to the best nationalities elsewhere on the globe.

I trust that some simple-working plan may be devised by which vital statistics of the school-children of our country may be collected, published, and circulated among our people.

XXIII.

SOME HINTS ON DIPHTHERIA IN THE MEXICAN HIGHLANDS.

By Dr. JESUS CHICO,

Guanajuato, Mexico.

Allow me, before entering into the subject I intend to speak of, to express in the name of the state of Guanajuato, in the Mexican Republic, the sympathy we feel for the endeavors of the American Public Health Association, and the desire we have to do our best to assist you in the blessed work you have undertaken.

I, in particular, express my hearty thanks for the kindness shown to us in allowing the use of Spanish, our dear native language. But I do not wish to profit by your goodness to bore you, so to speak, with listening twenty minutes to an unknown language, and I think it better to expose myself to criticism by translating my thoughts from a tolerable Spanish into a bad English.

Two words more: I come here wholly unprepared, not to say anything worthy of hearing, but only as a living testimony of the good will of my state. So you will excuse me if, instead of delivering an orderly lecture, I only make some hints on diphtheria in the Mexican highlands.

The way in which diphtheria made its appearance in our mild climates affords an illustration of the germ theory of infectious diseases.

All conditions which have always been deemed necessary for the production of this disease existed long ago in the Mexican highlands: filthy streets, dark and badly ventilated houses, consisting of a single room of small capacity,—occupied at night by all the inmates of the house, animals included; occasional fogs and sharp north-east winds;—in a word, nothing was amiss; and yet our children were spared from the ravages of this cruel foe of mankind.

But when the year 1863 came and the French invasion, with and among the Gallic bullets the little bacillus of Löfler found its way, and helped the work of the invader.

What an argument against the scanty misbelievers who, disdainful of the progress accomplished by science, still shake their heads when they hear about the new theories on infection!

Why, if there was in America both fertile land and abundant water before the arrival of the Europeans, was there no wheat? No doubt it was because there was no seed.

Malaria is universally recognized as originating in swamps where there

is a great amount of decaying organic matter. Well, then, in New Caledonia the swamps extend over a very extensive area, and the travellers are obliged to walk many miles merely leaping on the roots of the trees. Yet, notwithstanding all these eminent malarial conditions, strengthened by the tropical heat, New Caledonia is free from malaria. *The seed has not yet arrived.*

When diphtheria's seed arrived in Guanajuato, it caused an epidemic, of which there is still a sad record. In this, its first appearance, the mortality reached the heavy rate of 100 per cent.

But few were attacked, and though it is impossible to know the exact number (because in those days the register's office passed from the hands of the church to the hands of civil rule), I do not fear to say that in a city of 50,000 inhabitants it did not exceed twenty. In those days of civil and foreign war, and of more than relative ignorance, the public spirit was in so depressed a condition that neither authorities nor single citizens took the slightest possible measure to prevent the propagation of this dire calamity. The parents continued sending the children to the schools, to the same schools in which the sick had been till their confinement in bed.

In the houses the isolation was a nominal one, and neither physicians nor anybody else did anything beyond the slightest degree of disinfection in the washing of their hands.

Anywhere else the result of this carelessness would have been a very terrible one, but in that blessed country there are ample providential means to supply the deficiency of human endeavors, and, thanks to the climate, the sickness limited its ravages in an incredible way. And if I have told you that the epidemic left a sad record, it is because it selected its victims among the best families. The year 1863—the date of the arrival of the French at Guanajuato and of the epidemic—passed along, and since then we have had several small epidemics, which vanish without any effort to check them. We physicians, now well aware of the possible danger, take every personal precaution we can, and admonish seriously the families to take the required measures; but in the immense majority of cases they give no heed to our advice, partly on account of their not being sufficiently educated to acknowledge the necessity of the sacrifices exacted, and partly because experience has shown them that the danger of contagion is a very remote one. The walls are neither scratched out of their first layers nor whitewashed; furniture, dresses, and bed-clothes are not burned, and the brothers and sisters of the patient do not discontinue their attendance at school.

For the sake of the possibility of a case of contagion, we cry always against such ways, but I fear we sometimes share to a certain extent the tranquillity of laymen. I could not take an oath that every physician who has given medical attendance to a diphtheria patient has afterwards washed his hands with an antiseptic solution or changed his dress; but I am well aware that they have not transmitted the ailment, either to their families or to others.

What does that mean? Come I here to sustain the non-contagiousness of diphtheria? By no means. From these antecedent propositions I only draw a new practical argument on behalf of the germ theory; that Löfler's bacillus is, like *bacillus virgula*, subject to *time* and *place*.

A town with an average temperature of 64°, with a dry atmosphere, is no proper *place* for diphtheria. Which is the proper *time* for this sickness? The time of the year when cold and humidity are prevailing—the winter. But we practically have no winter; snow-fall has been observed only three times in half a century. Rain is a rare occurrence, except in the first days of January. Then there is no proper time for the bacillus, except in a few days of the year. But allow me to emphasize it once more, although the *time* existed, and although the town had some conditions that could render it a proper *place* for diphtheria, this sickness was not to be found among us until it was imported. Hence, neither *time* nor *place* creates this disease; they simply favor it.

Certainly, diphtheria now exists in the Mexican highlands, and—though, as I have already told, experience has taught that a certain extent of carelessness is not decidedly dangerous—as soon as the parents hear a child with the hoarse and veiled cough, like that of a dog, they immediately hurry for the doctor, and ask for an instantaneous diagnosis, and demand the physician to repair in a moment the long before begun work of the germ. Naturally, the first thing we do is to ascertain the nature of the case. We obtain, with more or less facility, an insight of the throat of the patient, and happily, in ninety-eight per cent. of the cases, we find only the signs of a catarrhal pharyngitis. We tranquillize the family, and the averted ghost of diphtheria is made anew the subject of jest; because a seldom deceived experience has taught us that in Guanajuato, when there are no signs of diphtheria in the throat, the larynx is also free.

But in nearly two per cent. we see, with anxiety, white spots on the tonsils or in the pharynx, spots which are not to be removed. Is it an herpetical manifestation? Is it the first pimples of a small-pox modified by vaccination? or, finally, are we confronting the fearful disease?

If there are greyish white, narrow spots alongside the uvula and corda palatina, we do not hesitate to proclaim the case to be one of diphtheria. But if such is not the case, there is room for hesitation; we caution the family against the possibility of a spreading of the disease, and advise and act as if the diagnosis were a sure one.

Now a few words about the treatment, giving my own experience and the experience of my colleagues in Guanajuato: The most efficacious internal medicine we have found is sulphur given in a combination apt to produce rapidly the sulphide of hydrogen, HS. So a sulphide of sodium or of calcium, especially when granulated, is a good preparation. But to obtain some effect it is necessary to administer doses strong enough to give the patient the smell of rotten eggs, indicative of an active elimination of sulphurated hydrogen through the lungs.

As for local treatment, I tell you plainly that *we wholly reject the use of*

strong, escharotic solutions of nitrate of silver, of sesquichloride of iron, of bichloride of mercury. They do not destroy the bacillus; what they do destroy is the still healthy epithelium, which is the best protective against the introduction of new germs. Perhaps some of you will tell me that with the same solutions I blame and object to you have obtained great success.

So I have sometimes believed, after having successfully applied in some cases one of these solutions, or a solution of chloride of zinc, which I had forgotten to speak of. But I have met with such fatal cases under the same method, that it seemed as if the contact of the medicine was the cause which produced the pseudo-membranes. So I have been led to believe that the favorable cases were so by nature, or, to speak in another way, that they had been produced by a weak, ill-developed germ, and would have been cured any way.

I think the especial reason of the frequent bad success of this kind of treatment lies in the difficulty, which often approaches to impossibility, of obtaining from a child a proper degree of obedience. Little children in their first years are generally, and with good reason, spoiled, because the amount of severity which would be necessary to employ to enforce every command of the parents would injure their tender nervous systems, and render them perhaps neurasthenic for the future. Every family has ways and means enough to obtain obedience, with gentle tricks, in ordinary cases; but when disease comes, then all those means are inefficacious in the majority of the cases. Every application of antiseptical solutions is a struggle; the opening of the mouth and the lowering of the tongue are obtained with great trouble. In the meanwhile the poor little patient is attempting to cry and impairing the condition of his throat. Everybody is anxious to finish at once, the application of the brush is made in haste, and its result is therefore far from being a good one; an unexpected movement of the child has caused the brush to touch and impair the healthy epithelium instead of destroying the germs of the pseudo-membrane.

With grown children, conscious of the danger and desirous of avoiding it, we can obtain the necessary amount of submission, and then the antiseptical local treatment enters on its legitimate ground.

With little children the only local treatment we prescribe is a powder of boracic acid and sugar, *to be swallowed without any draught afterwards*, but allowing it to go gently, with the child's saliva, down the throat. We seldom resort to tracheotomy; for what kills our little patients is not asphyxia, but the degenerative process of the pneumogastric or vagus nerve, which, beginning in the little branches which go to the throat, extends upwards to the cardiac branch, and produces death by slow or sudden paralysis of the heart.

When resorting to tracheotomy, nothing is more frequent than death from surgical shock in the very first stage of the operation. My whole life long shall I remember a lovely child, nephew of one of my dearest colleagues. We had only made the first incision of the skin when the

poor boy asked to be allowed to sit up, and when we were trying to persuade him to be quiet, his whole body shook and he died instantly. What is to be noted is that there was not a single sign of impending paralysis of the heart; the pulse was full and perfectly regular, and the child received good quantities of food (milk) and small doses of French cognac to strengthen him.

Gentlemen, I am at the end of my speech. Please remember that I have not intended to deliver a lecture, but only to make some hints on something, and principally to protest the good will the people and government of the state of Guanajuato bear for the American Public Health Association.

XXIV.

ARSENICAL PAPERS AND FABRICS.

By CLAUDE C. HAMILTON, M. D., Ph. G.,

Professor of Analytical Chemistry in the University Medical College,

Kansas City, Missouri.

The short time allotted me in preparing this paper does not admit of any quantitative work, nor of much elucidation of the results of my tests. The experiments were conducted to learn to what extent the papers and fabrics used by school children in Kansas City carried arsenical colors; it having been proven that such arsenical colors have caused serious complaints, and in many instances death.

The test used was Gutzeit's arsenic test, and was applied as follows: In a test-tube was placed a fragment of granulated zinc, and then enough hydrochloric acid (15 per cent.) to cover it. The piece of fabric (1 by 3 inches) was introduced, and the mouth of the tube covered with a piece of white filtering-paper moistened with a solution of silver nitrate. Hydrogen gas will be evolved, which, if arsenic be present, will contain arseniuretted hydrogen and blacken the silver spot on the paper. If desirable, the test can be applied to larger quantities of the fabric by substituting a flask for the test-tube.

Samples were procured at the same places where children have been known to have bought them. One circumstance is worthy of noting: While in a dry goods store, a lady purchased a few yards of blue calico to make school dresses for her two girls. The clerk was heard to remark that she had cut several school dresses from the same piece. The price was seven cents per yard. Several pieces of the same kind in different colors were found to contain large quantities of arsenic, as was shown by the complete reduction of the silver nitrate to metallic silver.

The following table gives briefly the results of the experiments. The color of the silver stain shows the relative amount of arsenic,—brown showing least, then black, while metallic silver shows large quantities.

	No. of samples examined.	No. containing arsenic.	No. not containing ars.	Character of silver stain.
French tissue paper, red,	3	0	3	
" " " purple,	3	0	3	
" " " green,	3	3	0	Black.
" " " yellow,	5	5	0	"
" " " orange,	5	2	3	Brown.

	No. of samples examined.	No. containing arsenic.	No. not containing ars.	Character of silver stain.
Shelf paper, blue,	5	3	2	Brown.
" " white,	5	0	5	
" " pink,	5	1	4	Black.
Blue calico,	5	5	0	Metallic Silver.
Covers of school-tablets, lithographs, and colored prints,	4	4	0	Metallic Silver.
Candy wrappers, " kisses," all colors except white,	1	1	0	Black.
Book covers,	4	0	4	"
Lamp shades,	5	3	2	Brown.
Artificial flowers, all colors except white,	5	3	2	"

XXV.

ARSENIC IN PAPER AND FABRICS.

By F. C. ROBINSON, Professor of Chemistry, Bowdoin College,
Brunswick, Maine.

I have often thought, when listening to papers read before scientific bodies, that, as a rule, too much space was given to rhetorical introduction. It is always interesting, of course, to be told that the topic under discussion is the most important of any which could possibly be considered, and it must be gratifying to those who have made out a programme to learn that they have used such great discrimination.

It is perhaps a trifle hard on the committee having the next meeting in charge, but I suppose that one meeting is so completely forgotten before the next one is held that the "old, old story" can be counted upon to be as fresh as a new tale.

I will, however, venture to depart from such a custom, if it is a custom of this Association, and, at the risk of being over-brief and uninteresting, tell you in a very few words my experience and views on this matter.

First, my experience: I have been a teacher of chemistry in a college in Maine for seventeen years, and during a large part of that time have held the office—more pretentious in name than in fact, perhaps—of state assayer. It is one of those ill-defined, go-as-you-please kind of offices, of which, perhaps, other states besides Maine have examples. One of the especial privileges associated with it is that of explaining from time to time to irate citizens, to whom you have sent your bill for analytical work, that you are not living off from the public funds which their taxes create, as they are careful to state, and in fact get no salary at all. One generally has the satisfaction, too, after making this point perfectly clear, of being told that the work was then done under a misapprehension, and hence will not be paid for. In addition to this rather nondescript office, I have been a member of the state board of health for several years.

But however important these various positions have been to me from a pecuniary point of view, they have resulted in giving me quite a large practical experience in connection with the subject of this paper. Even before the State Board of Health for Maine was created, the agitation of the matter of arsenic in paper and clothing in other places, especially in Massachusetts, spread into Maine, and samples of such things were continually being sent me for analysis.

Shortly after I became a member of the state board of health, that body determined to make investigation of the matter in Maine, and asked me to take charge of it. That was in 1889. In following out that request I have made a good many analyses, and am still making them from time to time.

So much for my opportunities. Now for the results: First, the results of my earlier analyses show a larger percentage of arsenic samples of paper than my later ones. But one reason for this undoubtedly is, that the samples sent were mostly from rooms which had been long papered and with the suspicious green color. Indeed, the impression formed was, that no color but green contained arsenic, and the same idea is quite prevalent even now.

My recent work has shown a very small percentage of papers which contain more than a mere trace of the poison. Three out of every hundred analysed, expresses the percentage quite accurately. I mean by a trace, less than one tenth of a grain per square yard. It will be inferred that my investigations have been chiefly with wall-papers. Such is the case. I have, it is true, analyzed some other fabrics, but not more than a dozen, and have found none containing more than a trace of arsenic.

Speaking, then, from personal experience, I can say that wall-papers are offered for sale, and are on the walls of many houses, which contain notable amounts of arsenic. One, and that was on a room in my own house, contained 125 grains of pure arsenic per square yard.

I might now leave the line of my own experience, and cite that of others, both in this country and abroad, but the work of others is better obtained from their own writings than from any summary which I have space for here, and all intelligent physicians have access to such writings. I will, however, simply say that investigators of the matter, and those holding strong opinions upon it, are found outside the state of Massachusetts; showing that it is by no means simply a "fad" of a few "cranks" in that state, as might be inferred from some of the testimony at the hearing on the subject there last winter. Many of you have doubtless read the admirable summary of some of these results in the Annual of the Universal Medical Sciences for 1888, vol. 5. If not, you will find it, as Horace Greeley used to say, "mighty interesting reading."

Now it is a very difficult matter for a man, even a scientific man, to simply make investigations and obtain results, and not found some opinion upon them. If he has the true scientific spirit, he will not be too dogmatic in his opinions, especially if all possible data have not been obtained. Even after he has stated his opinions, he must also be prepared to find that others will come to different conclusions, even from his own work.

But, in spite of all this, it is right that he should fairly state any conclusions which he may think warranted; and I will do so in this case.

But first, in order to make my data complete, I ought to state whether any of these samples found to contain arsenic were thought to have caused sickness in any person. I will say that not many of them were so sus-

pected. In fact, of course only a few of all examined had ever been used to my knowledge. They were taken from the shops in our cities in most cases. To be exact, only four "suspects" were among them. In each of these cases, persons living in the rooms were said to be affected in such a way as to lead to a suspicion of arsenic poisoning, and in every case the paper contained arsenic in large amount. The lowest had five grains per square yard, and the highest 125.

Of the whole suspicion and results, in all but one case, I know no details which would be considered as evidence in a court of law; and I will only say, in reference to them, that relief was said to have come after removal of the paper, I think in all the cases. But, fortunately or unfortunately, the most typical case of all occurred in my own house, and of that I can speak accurately. A small room in which two boys slept, aged seven and nine, was papered with an imported English landscape paper. The boys were in vigorous health when they began using the room. In the course of a few months they began to be unaccountably sick, not continuously, but intermittently. They would seem to be having the beginnings of a cold,—that is, their throats, eyes, and noses would show signs of inflammation. But instead of progressing in the usual way of a cold it would result in what we called a bilious attack,—that is, they would lose their appetites, and vomit at intervals. At this stage they would be removed from the room in question to another more convenient for waiting upon them. In a day or two they would apparently recover. Each had several attacks without exciting any suspicions in my mind that anything unusual was the matter. One day my attention was called to the symptoms of arsenic poisoning, and their similarity to those of my children struck me at once. I lost no time in examining the paper, and found the excessive amount of arsenic already mentioned.

The paper was removed, and no recurrence of sickness followed. While the room was being renovated, I made some tests upon the dust which had collected over the door-casings and under the carpet, and found that arsenic was everywhere present in it.

That the boys were being slowly poisoned I have not the least doubt, neither has any one familiar with the circumstances.

Of course the question was asked me at the time, and has been repeated many times since, Why did you allow such a paper to go on your room, especially considering that you had analyzed many papers for others? The fact is, I never had much belief in the possibility of such poisoning, up to that time. I had read about it, and examined papers for others, but I was of that number who regard the whole matter as a kind of scare. While admitting the possibility of a sensitive individual being influenced unfavorably by arsenic paper, I did not believe that a healthy person could so suffer, and regarded the sensitive person as rather a theoretical than practical individual.

You can see now why, to my former statement that I know from personal examination that papers are being sold containing a good deal of

arsenic, I can also add that I am of the opinion that some of such papers are dangerous to health.

I am aware that this Association is a conservative body, and does not wish to have rash statements appear in its publications. I believe in that principle myself, and hence I have tried to state my experience in this matter as carefully and guardedly as possible.

A few words more, and I am done. As many of you know, the state of Massachusetts has been the most active in bringing this matter to the attention of sanitarians. Several reports upon it have appeared in her board of health publications, and at various times efforts have been made to have some kind of a law passed. At the last session of the legislature a long hearing was held on the matter, and much interesting testimony given. The result of that hearing was, a law instructing the state board of health to make investigations, and report to the next legislature. That report we shall await with interest. But, after all, it seems to me that the consistent attitude of a sanitarian towards the matter should be based not so much upon the citation of cases as upon the possibility of danger. If no case of apparent arsenic poisoning from wall-paper had ever been brought up, it would still be our duty to prevent, if possible, the use of it where it was only theoretically dangerous. Sanitary science aims to prevent disease. In its beginnings it had to wait until an evil had done much deadly work before it could get power to battle with it, but it must be more and more anticipatory in its work in the future. Carefully discerning a possible evil in any direction, it must destroy it before it becomes an actual one.

It will get the sneers of so called "practical men," as was seen in the Massachusetts hearing, but it must not heed them. That general is always less thought of, at the time, who prevents a battle, and he who would provoke one is the hero ; but when the tactics of the former lead to the surrender of the enemy without bloodshed, his true superiority appears.

We should not forget, too, that one of the chief tendencies of modern science in all directions is to magnify the effect of small things. Formerly, if there was a good result, men looked for a mighty cause. This was especially true of physicians. Powerful maladies were fought with powerful doses. If a drop was good a quart was better, was the apparent principle. How differently the true physician works now! Gently guarding his patient from all adverse influences, neglecting not the most trifling thing, he skilfully coaxes back the vital energy with such a gentle use of drugs as would make an old physician look upon him with contempt. Seeing, as he does, the effect of the germ, so minute in itself as to escape his most powerful glass, yet causing the most violent sickness ; or tracing a rapid and irresistible malady to an almost infinitesimal amount of a ptomaine, he learns to recognize power apart from mere size and weight. Chemistry has undergone the same change. From a science of grammes it has changed to one of tenths of milligrammes. What the analyst of a few

years ago expressed by trace, meaning an insignificant amount, the modern chemist not only gives in figures, but sees in it perhaps the most significant thing present. The whole science of metals is being reconstructed on the basis of traces.

In view of these things, can we look with indifference upon the use, even of what may seem to be a small amount, of poisonous matter in our domestic surroundings? Is it not safer to demand the absolute freedom of such things even "from the appearance of evil"?

XXVI.

GLANDERS IN MAN, WITH THE REPORT OF A CASE.

By JOSEPH SHARP, M. D.,

Prof. of Materia Medica and Therapeutics in Kansas City Medical College,

Kansas City, Mo.

The small number of cases reported in medical literature would seem to indicate that glanders in man is of rare occurrence. Yet there have occurred in this city (Kansas City, Mo.) in the last ten years at least two cases besides the one here reported. Then, in all probability, more cases have not been reported, not because they have not occurred, but because they have not been distinguished from pyaemia, tuberculosis, or syphilis. In other words, the difficulties of diagnosis that delayed the recognition of this disease in man to the late period of 1821 still prevents its recognition. Glanders belongs to that group of infectious diseases in which the production of granulation tissue is pathologically distinctive. In this group belong tuberculosis, of which we now know lupus to be one manifestation, syphilis, leprosy, actinomycosis, yaws, and rhinoscleroma.

In all of these diseases the presence of a bacillus has been found, and with greater or less certainty proved to be the cause of the disease. The bacillus tuberculosis is best known, and its connection as the causative factor most clearly made out. The bacilli found in syphilis, leprosy, and glanders (bacillus malleus) are morphologically similar to the bacillus of tuberculosis, but have no such distinctive relation to aniline dyes. It thus happens that although the discovery of the bacillus malleus was announced as far back as 1882, contemporary with the discovery of the bacillus tuberculosis, we have no such easy means of distinguishing it from other micro-organisms as we have in the case of bacillus tuberculosis. In part, the object in reporting this case is to relate some of the difficulties in staining and cultivating this organism which prevented myself and friends from getting a decisive result demonstrating the bacillus. The case, imperfect as are the results in regard to the bacillus, is reported with the hope that some one else will be better equipped to meet a case.

L. M. M., aged 51, a painting contractor. His father died insane. The patient had suffered occasionally from fits of melancholia. He owned several horses, which were usually cared for by himself and sons. About the middle of November, 1890, he had a sick horse, with open sores on the legs, for which he cared, washing them and applying medicine under the direction of a veterinary surgeon. On November 14, 1890,

he ran a splinter under the nail of the third finger of the right hand. This splinter he removed by notching the nail back over the matrix. On the 18th, the sick horse began to discharge from the nose, and the disease was declared by the veterinary to be glanders. On the following day, November 19, Mr. M. first consulted me in regard to the possibility of infection. At this time the finger seemed entirely healed, there being only a whitened and thickened condition of the skin and tissue under the edge of the nail. He reported that his hands had been repeatedly washed in carbolized water. The patient had been exposed to infection six days, was of a highly neurotic predisposition with a tendency to melancholia, so that I thought it best to assure him that there was very little danger, and to order only a brisk purgative.

On Sunday evening, November 23, the tenth day after the injury to the finger, he was sick at the stomach and vomited. On the following morning he had a chill, followed by fever. At 2 p. m. his temperature was 103.5° F., pulse 90, tongue coated, and there was aching of the limbs and soreness of the joints very similar to the beginning of inflammatory rheumatism. At this time there was a sloughy appearance of the end of the finger at the site of the splinter wound, with a watery, sanious discharge. From this time on to the time of death of the patient, eight days later, there was continued high fever, the temperature ranging from 103° F. in the morning to 105° F. in the evening. After the third day of the disease, the soreness and stiffness of the extremities were limited to the right arm, upon which, near the elbow, two small phlegmons appeared, with a small vesicle on the back of the middle finger, one on the wrist, and one over the collar bone of the right side. The larger phlegmon developed pus on the fifth day, and was opened. On the fifth day a large phlegmon, about two by two one half inches in area, developed over the lower ribs of the right side. This phlegmon was aspirated on the seventh day with a hypodermic needle, yielding only a red, watery serum. On the seventh day, eight or ten pustules, varying in size from about the one sixteenth to one quarter of an inch in diameter, developed on the scalp and face. These pustules had a deep purplish border, with a white, curdy-looking pus in the centre, which, when evacuated, left a deep excavation in the skin.

Beginning about the fourth day, the patient expectorated frequently a glairy secretion, apparently from the pharynx and the posterior nares, although there did not seem to be any marked redness of the mucous surfaces, nor was there any ulceration to be discovered here or in other parts of the upper air passages during his illness, or on inspection after death.

In the last three or four days of his illness, marked prostration, with dry, brown tongue and soddes on the teeth and lips, came on, together with spells of marked syncope. Death occurred on the eighth day from collapse.

A post-mortem examination was made about fourteen hours after death.

External examination revealed a sloughy excavation on the end of the finger at the site of the wound; vesicles, three or four in number, on the same hand and forearm; a phlegmon and a pus cavity, near the elbow, on the forearm; pustules, not to exceed ten in number, on the breast, face, and scalp, three or four of which were on the scalp; lastly, the large phlegmon, before spoken of, in the subcutaneous tissue in the right hypochondriac region.

Internal examination—only the abdominal and thoracic cavities opened: Heart, normal in size, filled with grumous, black blood; lungs normal, sections did not reveal any nodules; liver normal, sections did not show any abnormal appearance. In attempting to draw the spleen forward in the abdominal cavity, it broke down in the hand, showing a dark brown, grumous mass. The other abdominal organs seemed normal.

Microscopical examinations were made of material from the primary wound, from the vesicles, and of the pus taken from the subcutaneous abscess near the elbow, from the contents of the pustules, and of the fluid drawn out of the phlegmon on the side, as well as from the glairy mucus wiped from the posterior nares, by my friend, Dr. W. H. Bichmore, and myself, with negative results as to finding a micro-organism. This result was doubtless due to our want of knowledge as to the best staining methods.

In smear cover-glass preparations from the broken-down splenic material, stained with methyl-violet alkaline solution and washed out with a weak solution of oxalic and sulphurous acids, after the method of Loeffler, a bacillus, morphologically like that of tuberculosis, was found. Attempts at cultivation on beef—peptone—gelatine were negative, probably on account of the gelatine's softening at the high temperature necessary for the growing of this organism.

This case seems very typical of the acute form of this disease. The stage of incubation, if infection occurred on the day of the injury of the finger, as was most likely the case, was nine days in length. The early symptoms in many respects resembled the beginning of acute rheumatism. The whole course of the disease was much like pyaemia. In thirty-eight cases of this type there were, according to Bollinger, thirty-seven deaths. According to the same authority, the mortality, in the chronic form of the disease, was 50 per cent.; so that in this affection we have a most dangerous disease, and one in which prevention is of the greatest importance. The statistics of Bollinger and others show that those who come most closely in contact with horses, as grooms, coachmen, horse-traders, etc., are the ones most frequently affected. In many cases there has been evidence of direct inoculation. Reasoning from the analogy of the disease to tuberculosis and syphilis, it would seem probable that infection occurs only by inoculation into wounds of the surface, or, as in tuberculosis of the lungs, occasionally, into breaks in the mucous surface of the air passages.

The evidence that glanders is produced by the bacillus malleus seems

conclusive. The investigations of Loeffler and Schultz have fully come up to the tests announced by Koch for that character of investigations. While this bacillus morphologically closely resembles the bacillus tuberculosis, its relation to basic aniline dyes is the very opposite, it being discolorized most easily of all the pathogenic bacilli.

The following liberal translation from the fifth edition of "Zeigler's Lehrbuch Der Allgem. Patholog., Anatomie and Pathogenese," gives the staining and cultivation methods:

"To stain the bacillus of glanders [Loeffler] put the section of tissue for a moment into a solution of potash of 1 part to 10,000; then for a short time into an alkaline solution of methyl-blue (3 c. c. of a solution of potash 1 to 10,000) and one c. c. of an alcoholic solution of methyl-blue or gentian-violet. It should then be discolorized by a very short washing in water, 10 c. c. containing two drops of sulphurous acid and one drop of a 5 per cent. solution of oxalic acid."

"The bacilli grow equally well on coagulated blood-serum, or cooked sliced or mashed potatoes, at a temperature of 86° F. to 104° F. (30–40° C.). They form earliest amber yellow spots, turning red later from the presence of bacilli which contain spores. On blood-serum they form small transparent yellow spots changing to milk-white drops."

On agar-agar the colonies are grayish white. The life cycle of these organisms is short; in any given material it will lose its infectious qualities in a short time.

Loeffler found that exposure to a temperature of 130° F. (55° C.) for ten minutes sterilized material in which they were growing. A solution of one part in 5,000 parts of bichloride of mercury destroyed their infectiousness.

The following propositions seem justified from our present knowledge of this disease: 1. That infection occurs almost entirely through inoculation through wounds. 2. That the infection is local, becoming general sooner or later, thus determining the type of the disease.

From these propositions the following rules may be deduced: 1. That every person examining sores on horses or discharges from the nose, should at once disinfect the hands and person with a solution containing two tablespoonfuls of equal parts of carbolic acid and glycerine to one quart of hot water (1 to 170), or ten grains of corrosive sublimate to the quart of water (1 to 1,500). 2. Wounds, even the slightest abrasions, made while dealing with such horses, should be freely opened up and disinfected, or burned out with a white-hot iron wire or a strong mineral acid. It is to be hoped that in the future, medical colleges and colleges of veterinary medicine will give instruction as to the best methods of staining and cultivating pathogenic bacteria, thus rendering their graduates better able to make early diagnoses of this class of diseases.

XXVII.

ALGUNAS CONSIDERACIONES SOBRE LOS PROGRESOS DE LA HIGIENE EN LA REPUBLICA DE MEXICO.

By J. RAMON ICAZA, M. D.,
Mexico, Mex.

Sr. Presidente, Señores: Debo manifestar á la Ilustre Asociacion Americana de Salud Pública, la satisfaccion y el placer que experimento al venir á tomar parte en sus importantes reuniones.

Me felicito, Sres., y felicito á mi querida Patria, por haber llegado á una época, en la que, bajo la sombra benéfica de la paz, podemos los médicos mexicanos dedicarnos á la mejora de las condiciones higiénicas de todos los Estados de la República.

Hace apenas algunos años, no hubiera sido fácil venir como ahora á este Congreso, en donde mucho aprenderemos, y aun, en nuestro propio pais, se les dificultaba á los médicos reunirse para tratar de las variadas é importantes cuestiones de nuestra profesion.

Antes casi puede decirse que viviamos como un hombre aislado que no tuviera maestros, ni modelos, ni ejemplos que imitar. Es claro que por mucha que fuera su inteligencia y dedicacion, y por larga que fuera su vida, no podria llegar á la perfeccion en sus trabajos.

Es verdad que siempre tuvimos en México, hombres sabios que se ocuparon empeñosamente en hacernos progresar; pero no podian adelantarse á su tiempo; faltaban los medios de comunicacion, las fuerzas estaban aislados, y tenian que ser poco eficaces en sus efectos.

Afortunadamente y gracias á la ya extensa red de ferro-carriles y telégrafos que poseemos, y al buen servicio del correo, estámos en relacion con los médicos del mundo todo, y podemos estar al tanto de los continuos adelantos de la ciencia.

Refiriéndome á la Higiéne pública de la que ahora debemos ocuparnos, no hay duda de que en México se hacen todos los esfuerzos posibles para majorar sus condiciones sanitarias.

Estamos todavía muy lejos de haber satisfecho nuestras aspiraciones; pero abrigamos esperanzas fundadas de realizarlas.

Asi lo creo, por que allá los esfuersos particulares de los médicos son estimulados por las corporaciones científicas, y ayudados eficazmente en sus tareas por el Gobierno federal y los de los Estados que bien comprenden la obligacion que tienen de vigilar por los intereses de la Salud pública.

Como una prueba del empeño de nuestras Autoridades políticas por el

adelanto de la higiéne, estamos aquí algunos de los médicos mexicanos; y como una demostracion del entusiasmo que hay en México por los estudios de esa rama de la Medicina, básteme citar la reciente publicacion de la curiosa é instructiva obra del Sr. Orvañanos sobre "Geografía médica y climatológica, y la de la memoria del Sr. Dr. Ruiz, sobre las enfermedades endémicas de la República Mexicana."

En estos escritos se encuentran noticias exactas respecto del Estado de Tamaulipas, que tengo la honra de representar.

Alli estan consignados su posicion geográfica, la naturaleza del suelo, extension, clima, poblacion, y enfermedades que dominan.

Asi por ejemplo, está señalado que el paludismo, en sus diversas formas, es endémico en todo el Estado; que la tuberculosis es frecuente y toma á veces la marcha sobre-aguda; que la hepatitis, la disenteria, las afecciones gastro-intestinales, y los catarros de las vias respiratorias se observan tambien, aunque en menor escala, como es natural en los climas húmedos y calientes.

No es mi intencion ocuparme de las medidas higiénicas que es preciso tomar para evitar estas y otras enfermedades que pudieran venir.

Estoy seguro que se procurará llevarlas á feliz término, por el activo é inteligente Gobernador del Estado de Tamaulipas, el Sr. Prieto, y por el Congreso de Salubridad que se organice, secundando las elevadas miras de nuestro Código Sanitario del que ha dado á Uds. una idea mi excelente amigo y sabio higienista el Sr. Orvañanos.

Yo espero que este congreso nos servirá mutuamente de estímulo para trabajar; que sin egoismo nos comunicarémos nuestros estudios y adelantos y asi cumplirémos con la noble mision que nos hemos impuesto de ser útiles á la humanidad.

PROCEEDINGS AND DISCUSSIONS AT THE NINETEENTH ANNUAL MEETING,

HELD IN

KANSAS CITY, MO., OCTOBER 20–23, 1891.

Tuesday, October 20, 1891.

MORNING SESSION.—10:30 O'CLOCK.

The nineteenth annual session of the American Public Health Association was called to order by the President, Dr. Frederick Montizambert, of Quebec, at 10:30 a. m., Tuesday, October 20, in Kansas City, Mo., in the Warder Grand Opera-House.

THE PRESIDENT.—You will, I am sure, share with me a feeling of satisfaction at noticing so many representative men already present at this our opening session, and in the assurance that we may expect a larger accession to our number by the incoming trains to-day. I take pleasure in formally announcing that the nineteenth annual meeting of the American Public Health Association is now open for the transaction of its business; and I am happy further to announce that Rev. Samuel N. Neel has kindly consented to open our proceedings with prayer.

The Rev. Samuel N. Neel then invoked divine blessing.

THE PRESIDENT.—We will now listen to announcements from the chairman of the Committee of Arrangements, Dr. E. R. Lewis, of this city.

DR. LEWIS.—On behalf of the local Committee of Arrangements, I have to announce that the evening session will be a public session, in accordance with the custom of the Association, and that the governors of both Kansas and Missouri have kindly consented to be present and formally open the session on behalf of the two states. The two mayors of the two Kansas Cities at the mouth of the Kaw have both agreed to be present with us, and extend welcomes on behalf of the local citizens of the two cities. And I am especially requested by the mayors of the two cities to say that if there is anything the doctors wish, they will be glad to serve them in any way possible.

The school board of the city has invited all those especially interested in heating and ventilation to visit the various schools in our district, and you will probably be surprised to know that we have over thirty large and well-constructed school buildings. The assistant sanitary superintendent and the engineer of the school board have consented to show any of you through the school buildings.

The packing-houses, which constitute the great industry in our midst,

have very generously extended to your committee an invitation, for those who desire, to see how the packing interests of this locality are conducted, and also to see how they make butter which is much more agreeable to the palate and the eye than that from a New England Jersey cow. The five or six large packing-houses will be happy to receive those who are interested Wednesday morning.

Dr. Sharp, secretary of the Local Committee, has in charge a division of a party for an excursion, and all who wish to go should report their names to him or to the Secretary's table. The whole company will be divided into four or five parties, just as the necessities of the case require. This excursion will be given to the Association by the Kansas City, Fort Scott & Memphis Railroad, tendered by Col. J. H. Nettleton, taking you into Kansas three or four hours' ride. All who desire to go are cordially invited, and should be ready by 2 o'clock Thursday afternoon.

On returning from this excursion, the members of the Association will be the guests of the Commercial Club of this city for Thursday night.

Those are the only entertainments which your committee have thought advisable, and which the officers of the Association have decided would be all the time that could be devoted to entertainments of any kind.

Cards of invitation have been issued for all the members to visit the New York Life building in our midst, which we believe is second to no structure of the kind in our country.

We also have invitations issued to the members by Bullene, Moore, Emory & Co., to visit their place of business, which we think is not only a model, but has more floor-space than any building we know of west of New York city.

The opera-house, which we are at present occupying, has been generously tendered by Col. Henry, of Chicago, who owns it. He has given it to us for four days and four nights for nothing. These are the arrangements that your committee have perfected at present. If there are any changes, additions, or corrections, we will be glad to announce them as the meeting proceeds. [Applause.]

Dr. J. D. Plunket, Nashville.—I would like to ask the chairman of the Committee of Arrangements one question. What is the nature of the business of Bullene, Moore, Emory & Co.?

Dr. Lewis.—It is a dry goods house, representing every industry, and it is simply to inspect their mammoth buildings and the floor-space that the members have been invited. I will state further, that this firm have contributed generously towards the entertainment of the Association.

The President.—We will now listen to the report of the Treasurer, Dr. J. B. Lindsley, of Nashville.

The report was then read.

Dr. Hibberd.—I move that the report be accepted. Motion seconded.

Dr. R. Harvey Reed.—I move, as an amendment, that the report be referred to the Auditing Committee. Motion seconded and carried.

The President.—I will appoint on that committee Drs. Reed, Durgin,

and Perkins. It is understood, of course, that the committee will report back to the Association.

DR. REED.—That should have been included in the amendment.

THE SECRETARY.—I have here the names of several gentlemen who have made application for membership. The Secretary then read the list of names.

THE PRESIDENT.—You have heard the names of the gentlemen who have been proposed for membership. What is your pleasure?

DR. J. N. MCCORMACK, Kentucky.—I move that the Secretary be instructed to cast the ballot of the Association for the gentlemen whose names have been read. Seconded and carried.

The Secretary then cast the ballot of the Association for the gentlemen whose names he had read, and they were declared duly elected.

THE PRESIDENT.—It is not presumed, gentlemen, for the chair to make any remarks upon the occasion of election of new members of an Association like this, but there is one feature in the election this morning which calls for some deviation from the usual custom. At our last meeting in Charleston, there were two distinguished delegates present from the Republic of Mexico, and their appreciation and interest in sanitary work have been sufficiently well shown. You will have noticed that a large accession of delegates this morning from the Republic of Mexico have been elected as members, and I think you will all agree with me in expressing the satisfaction of the Association upon this event, and in extending to each and all of these gentlemen a hearty welcome to our Association. [Applause.]

THE PRESIDENT.—This paper has been handed to me with the request that I read it to the Association.

The President then read the following: "The Mexican delegates, afraid of making a ridiculous mistake in pronunciation when thanking the Association for the kind reception they have met with, respectfully beg the honorable President, Dr. Montizambert, to express to this assemby their hearty thanks for the friendly welcome given to them." [Applause.]

Dr. Joseph Sharp, of Kansas City, Mo., read a paper entitled "Glanders in Man, with Report of a Case." (See page 217.)

DR. J. J. KINYOUN, of Washington, D. C., in opening the discussion, said,—There are two points which the essayist did not touch upon. The diagnosis of glanders, in either the animal or human subject, is not as easy as one would suppose. It cannot be done morphologically. In bacilli of the same size and which take on the same color and reaction, it can be done in a very short period by cultivation, either using ordinary glycerine agar-agar having beef peptones, and also upon spice potato. In the first place, the color is apt to be separated by the grape (?) method of agar-agar and transplanted. The growth on a potato is characteristic. There is no organism, I think, that can be confounded with it. The diagnosis can be made within the space of three or four days by this method, either from the mucous membrane of the horse or from the infected wound.

Another point, only brought out last winter in Russia, is in using the product of the bacillus to diagnose the disease, very much in the same manner as tuberculin is used to diagnose tuberculosis. That has been prepared by growing the bacillus in the primary form, subjecting it to heat for at least an hour, and precipitating a metabolic product by using citric acid, which, in a man suspected of glanders, will cause reaction the same as occurs during the incubation of glanders. This has been done successfully, and has been put into veterinary practice in the schools of Berlin. It is still under observation, however, and is not yet completed.

In regard to the infection of glanders, it does not always take place through wound infection, as Metchnikoff, the pathologist, has recently reported six cases from the bacteriological laboratories of Europe; and he says that the only way possible for infection to occur is through the respiratory mucous membrane. The opinion of most all observers that I have had conversation with is, that the rate of mortality is far above that altogether given by Bollinger. Usually about 99 per cent. of the cases die.

In regard to the treatment, I would offer the suggestion that it be treated in the same manner as anthrax, that is, by removing the infected area and using carbolic acid injections. This way of treating anthrax, especially in London, has been very successful. A number of cases have been reported from Guy's hospital, London. The diagnosis having been made within three or four days after the disease has been suspected by the cultivation of the bacillus, surgical measures should then be undertaken to afford relief.

Dr. Gauntt.—Dr. Sharp's paper was very interesting to me, and in the description of his case I am sorry he did not take one step farther. He went so far as to show that the abscesses and other excretions showed the presence of no bacilli as the cause of glanders. It seems established by bacteriologists that such is a fact, that each of the diseases has its specific germ-source. If he had gone a step farther, he could have proven whether or not the man had glanders by taking the discharges from the abscesses and applying them immediately to the animal susceptible to the disease. If he had inoculated a horse with the material from the abscess, he could have proven whether or not the man had glanders. He supposed so without proving it.

In this age of biological and bacteriological research, it ought to be proven by experimentation the same as is done in cases of hydrophobia. You must reproduce the disease in some animal before you conclude that a man dies of rabies or glanders because he has the symptoms of either one of these diseases. These are simply facts worthy of the careful consideration of this Association. We must not take it for granted that a person has a disease similar to an animal because he has the same symptoms. We can only reach conclusions in this regard by inoculating an animal more susceptible to the disease.

Dr. Paul Paquin, of Battle Creek, Mich.—I had charge for about six

years of the veterinary department in this state, and I had occasion to see five cases of glanders in horses. I collected about seventeen cases which had occurred in the state in man, but only one of them did I see myself. It is not so difficult to diagnose the disease as a great many physicians think, if the opportunities for bacteriological investigations are good. Great difficulty arises from the fact that the disease is not seen early enough and is studied so little, and physicians are doubly unprepared to distinguish it from a disease that may arise having similar symptoms, or the peculiar characteristic lesions which occur early in glanders. At the very commencement, the parts involved, in whatever locality it may be, are the lymphatics almost exclusively. For instance, if the lesion takes place in the finger or hand, the progress of the bacteria is very slow, and seems to be almost wholly through the lymphatic circulation, although it is transferred sometimes in the neighborhood of the inoculated spot. We may have an indication at the outset that is characteristic of it. Not all physicians are able to make investigations from bacteriological or pathological processes.

Another point is the history of a case of glanders. Glanders never occurs in man except through the horse. It is possible to find, as a rule, the source or starting-point of the case, and then if we find the animal affected with the disease the diagnosis is rendered easy. Glanders is not always transmitted by inoculation, but almost always. In animals it scarcely ever occurs in any other way; yet it is possible, if the virus be dry in a stall, for a man to inoculate himself. But, as a rule, inoculation occurs from fresh virus from animal to man. I have a case in mind which occurred is this state in 1886. The man contracted glanders by driving a glanderous horse which blew its nose, and the spray inoculated the man in the eye. The disease developed in that way. It was fresh virus. The virus does not live long when exposed to the atmosphere. It lives about thirty days. In buildings unprotected from atmospheric influences it lives a much longer time: it lives two or three years. I know of one case which infected twenty others in one stable, the glanders having existed for four years.

I have made experiments which show that after twenty or thirty days the virus will not take. Guinea-pigs are known to be susceptible to the disease. The history of the case is our best guide where we cannot resort to cultures of bacteria; also the symptoms of the disease. Medical colleges do not teach the symptomatology of glanders. You rarely, if ever, hear glanders spoken of in a medical college. I have heard it spoken of in a college of veterinary medicine. We should study the symptoms in the horse and then the symptoms in man.

Dr. Gauntt.—What per centage of mortality is recorded in the number of cases you mentioned, Dr. Paquin?

Dr. Paquin.—Two of the cases are living. The only case I saw personally was that of a man who contracted the disease in Missouri and afterwards went to live in Macon county, Illinois. He was advised to go

to a physician. He recovered under the care and treatment of Dr. Griffin. I am satisfied, however, that 99 per cent. is too great a mortality. The disease can be arrested in its progress, and successfully treated if the diagnosis is made early enough. There are few cases which progress rapidly in animals. In my experimental work with cultures and inoculations, I have found that iodide of potassium in large doses would arrest the disease if taken in the early stages. After a few days, when the disease has progressed, then it is too late to give it.

Dr. Gauntt.—Have you ever reproduced the disease in the horse by inoculating it with the virus taken from man?

Dr. Paquin.—I have not done that, for the reason it takes too long for each individual case.

Dr. Gauntt.—Would it not be the safest way to reach conclusions, to take the virus from man and then inoculate the horse with it?

Dr. Paquin.—Yes, I have no doubt it would; but, as I have said, it would take too much time to do it.

Dr. Gauntt.—If it takes fifty years it would not be too long.

Dr. Paquin.—We can inoculate guinea-pigs very rapidly, but it would take too much time to make the diagnosis in that particular case.

Dr. Hibberd.—If a horse is sick and dies, it seems to me it is immaterial whether it is glanders or some other disease that kills.

Dr. Gauntt.—We are inquiring about the cause and prevention of disease just now.

The Hon. Albert H. Horton, of Topeka, Kansas (chief-justice of Kansas), read a paper entitled "The Necessity of More Stringent Legislation to Repress Empiricism." (See page 24.)

Dr. R. Harvey Reed.—I move that the Association extend a vote of thanks to the Hon. Albert H. Horton, chief-justice of Kansas, for the able paper he has read, and that, as far as practicable, copies of it be distributed to the medical and sanitary press of the country as liberally as possible.

Seconded and carried.

Dr. W. D. Green, of Buffalo.—I feel that the American Public Health Association is to be congratulated for having this subject so ably handled by a gentleman so high in authority, and I think very many of the states have taken the matter under serious consideration. In New York state a student, in order that he may enter a medical college must have passed the Regent's examination, then after he has passed the Professor's chair he must pass the Board of Censors, receive his diploma, and then before he begins to practise he must pass the State Board of Medical Examiners as well. In that way he must necessarily be well educated before he can practise.

Dr. Joel Smith.—As one of the medical profession, I feel that there is something to be said on both sides of this subject. Residing as I do in the state of Iowa, we have a medical practice act which is very little better than a name. When the legislature has been importuned to do some-

thing for the protection of the profession, the cry has been raised, "Oh, it is for the benefit of the doctors." The result is, gentlemen, we have been treated badly and lampooned in our state. Some claim that we do not need any such law for the protection of the medical profession, and that is the form it takes. I have labored for years in that direction. The New York and the Illinois laws are steps in the right direction. We are particularly fortunate in having such high authority as Judge Horton to present this subject for consideration, because it will not be considered the physician's view.

The subject of empiricism is an unpleasant one to discuss, and it is not at this time all outside of the profession. That is where the difficulty is.

When we can make medical men act in accordance with the ethics of our profession, then perhaps the law can be made to conform to our wishes. We want to elevate the character of the profession. Some of our medical colleges are doing good work in this direction; while others are turning out uneducated and unqualified men. The state of Illinois has something like five hundred empirics, who simply prey upon the public, and extort money from them without giving treatment for value received. A large number have been driven out of Chicago, and like a wave of bad air they have spread over the adjacent states, and we are suffering the evil consequences of it. I would like to hear the opinions of some of our medical brethren on the subject.

Dr. Edward Clark, of Buffalo.—The doctor claims that the existence of quackery lies at the doors of the medical profession. I do not believe there is a regular physician in the country but what is opposed to quackery. In New York state we have stringent laws, and they are so explicit that anybody can understand them. Time and time again we have had quacks arrested in our state and had them taken to court, and invariably have failed to convict them on account of the apathy exhibited by the lawyers, court, and jury. That is where the fault is. Almost every state, so far as I know, has statutes regulating the practice of medicine. As I have said before, while we have had these men arrested, and procured sufficient evidence to justify their conviction, we have invariably failed to secure justice at the hands of the courts. I do not make this charge against the higher courts, but the lower ones, where the cases are referred to juries.

Dr. J. N. McCormack, of Kentucky.—I have listened to the paper with considerable interest, because I have for many years been engaged in this line of work in Kentucky. In the last five years we have been able to secure fairly satisfactory legislation with fairly satisfactory results. While our law is not stringent in regard to empirics, and while I am sure the only complaint that can be made against it is that it is not strict enough, we have succeeded in compelling nearly five hundred so called doctors to retire from practice or to leave the state. Two of the most notorious of these empirics, I am sorry to say, have located in the state of Kansas—one I believe in Topeka. I recently received his circular, which stated that he had opened a large medical institute, and from the character of his

advertisements I suppose he is doing a thriving business. I am sure we are gaining ground all over the country in the matter of medical legislation. I know Illinois has been the pioneer state in this kind of work, brought about largely through the energetic efforts of Dr. Rauch. If one will examine the reports which Dr. Rauch has issued from time to time, he will see the progress that has been and is being made on this subject. There is a growing sentiment with the profession, and an increased efficiency in medical laws.

In our state we have had great difficulty in securing the conviction of empirics. Our law is plain and simple, and in a very large number of instances these men have been brought into court and fines imposed on them. Some of them, after having been prosecuted two or three times, have left the state.

I want particularly to express the interest I felt in listening to the able paper.

Dr. R. Harvey Reed.—I want to say a word first in commendation of the paper, as well as of the efficient work done by Dr. Rauch in this direction. As a citizen of Ohio, we have felt the effects of Dr. Rauch's work in the cause of medical education by the immigration from Illinois over into Ohio of these pretended medical men.

There is also another feature which we shall have to take into consideration before we are able to eradicate this class of pretended medical men. Whenever a question of this kind is brought before the legislature, we, as medical men, have to battle with two prominent parties—first, the quacks themselves, who arraign themselves against us and furnish large sums of money to buy off the legislature; and, second, the general press of the country. Why does the press uphold the quacks? It is because they pay the press more money than we do, and it is the press that helps them to down the law. It is on account of the large sums of money that they pay the press for advertisements, that it upholds them. These empirics may have half a column or half a page of an advertisement in a newspaper, and they pay perhaps hundreds of dollars for it, while we are allowed a little card. We do not want anything more, and we may pay $5 for it. The result is $5 against $500, and "money makes the mare go."

If we, as medical men, cannot have medical laws enacted in the legislatures, we can do another thing,—we can raise more money than the quacks, if we desire, for the press, and then the press will drive quacks out of the states quicker than lightning. I know of an instance of this kind in my own state. We did not pay the press for it;—the press was honorable, and it was remarkable how these empirics were driven out of Newark and Lima in a few days by exposing them. The press should have been paid for it, because they did it voluntarily. It is a fair example of what can be done in this way. If we cannot get the press to do it in a philanthropic way, we can get them to do it by paying for it. As soon as we get quacks out of the states, we can pass laws that will protect us and the people from them.

I do not claim that it is wrong on the part of the newspapers to accept their advertisements, because they are running for money, and we cannot find fault with them for this; but I am sure we can wipe out empirics in this way if we desire to do so.

Dr. Howard E. Ames, of Washington, D. C.—I desire to make a few remarks on this subject. I have had something to do with quacks, and I would offer a suggestion to our local and state boards of health, which I think will assist in suppressing quacks. I helped, by adding my testimony, to expel several quacks who advertised extensively in our city. Five hundred dollars was left in the hands of the state to drive them out. They were driven out. I casually inquired, Where did they go? Well, we do not know; they got out of here, that is all we are after. They, of course, went to some other state. It would be a good thing if medical men and the law could combine a little and find out where these men go, and inform the local authorities of the towns in which they settle again of their quackery,—inform them by means of a small circular-letter, that such an individual has been driven out, locally or otherwise.

Dr. Gauntt.—I will not occupy much of the time of the convention in discussing the able paper that has been read. Suggestions have been made that something should be done to repress quackery. We can do nothing except follow the example of other states. New York has a law which meets every emergency—I can also say the same for New Jersey—and which can be enforced, compelling every applicant for a license in the state to practise, to go before a board of examiners. This board is selected or made up of all classes of physicians, without regard to pathy. The board requires of the applicant the highest standard of excellence in the profession. It is doing a work that is very desirable.

The President.—The following resolution has been handed in by Dr. Reed, which will be read by the Secretary, and then submitted to the Executive Committee:

Resolved, That the Secretary be authorized to send reprints of the paper read by Hon. Albert H. Horton, chief-justice of Kansas, entitled "The Necessity of more Stringent Legislation to Repress Empiricism," to the Medical and Sanitary press of the United States, the Dominion of Canada, and the Republic of Mexico.

The President.—The next paper is on "Water-Supply and Public Health," by Mr. Allen Hazen, Lawrence, Mass. (See page 74.)

Dr. Peter H. Bryce, of Toronto.—Is it intended that the Association continue its work until 2 o'clock, or till all the papers are disposed of on the programme? I think the discussion of this very important paper should either be postponed, as well as the reading of Mr. Butts's paper, or we should have it definitely understood at what time the meeting will convene in the afternoon. If there is to be no afternoon session, it should be understood that we go on until half past two.

The President.—There is no afternoon session. It is not stated on the programme.

Dr. Maurice Perkins, of Schenectady, N. Y.—In speaking of the pollution of a running stream, it seems a little hard to understand. We must remember that cholera has never found its way down the stream, but always up. Cholera has been found in Italy, France, and India towards the mouths of rivers, and has not found its way from the source of the river down towards the mouths.

In the case of the typhoid epidemic which we have had in the eastern part of the state of New York, it is one of the most trying epidemics we have ever had. In the careful consideration of these cases, over sixty per cent. of the people that took the fever did not use river-water. In the case of my own town, Schenectady, we had water which was supposed to be charged with typhoid-fever germs, and out of ninety-seven cases of typhoid fever, eighty-nine of them used well-water; and while I think there may have been germ poison in the river, I do not think it was the cause of the typhoid epidemic which we had running along the line of the river, starting from Schenectady and passing down West Troy and Albany, where, to a certain extent, the river catches the typhoid-fever germs at Schenectady. Typhoid fever had been reigning in Schenectady for eighteen months, and we were able to stop it before any such thing as an epidemic reached Albany and elsewhere. It continued, however, in Schenectady for some time. I will give you a reason why we had typhoid fever. We have a new manufacturing establishment, which within the last five years has increased from nine persons employed to between 3,000 and 4,000 hands. We have had an influx of people coming in to find work. A great many of the men came in in an abnormal condition. Most of these persons had been searching for work for weeks. They were exposed physically, and were troubled mentally with anxiety, and they would go to a small room where perhaps their food was not as good as it was at home, and they were taken with continuous fever. The question arose whether it was typhoid or not. We discovered no germs in the river, and we have perhaps the best bacteriologist in the United States in the person of Theobald Smith, of Washington, D. C. He has discovered a germ, but it is not a typhoid germ. I think we should exercise great care in regard to the water, as to whether it is contaminated or not; but the question of contamination by typhoid germs is to my mind one that has been satisfactorily proved.

Dr. Clarke Gapen, of Omaha, Neb.—I would like to say a few words in connection with the subject under consideration. Perhaps there is not a gentleman here but knows that the water-supply taken from the Missouri river in Kansas City and Omaha is one of the most complex and difficult problems that exists in the United States. Since my introduction into the office of Commissioner of Health of Omaha, I have been following up this subject persistently for some months, and I have not finished the subject yet, but I have gone so far as to secure the corporation government's consent to pursue it, and we have been endeavoring to solve the problem of making good water out of bad.

We have in the Missouri river not only the problem of mud and organic matter to contend with, but we have the problem of sewage that is derived from its source. The problem of organic matter is easily solved. We have probably in Omaha as many settling-basins as there are in any city in the world. We have seventy acres of settling-basins. When I began my investigations of this subject I found by repeated analyses that the organic matter present in the water varied from thirteen one thousandth parts per million of albuminate of ammonia to twenty-four one thousandths, the amount of organic matter being larger in the winter-time. For several months we have been making an examination of the water and publishing the facts, until now the water-works company are taking an interest in the matter and we are working conjointly, taking samples, etc. We find that the proportion varies, as I have stated, from thirteen one thousandth to twenty-four one thousandth parts to the million. Settling and aeration apparently reduces this to four or five one thousandths parts per million.

I think the most light that has been thrown upon the subject has been by the work of Mills and others, and I regret that the gentleman who read the excellent paper did not elaborate that idea more fully. It seems to me that Mr. Mills has discovered the principle of purification of sewage, which is an important matter. He goes on to show that it is necessary, to purify water, that it shall be spread out in a very thin layer in order that this layer may be accessible to bacteria—non-pathogenic bacteria are the great purifiers of water; and that the processes which destroy organic matter also destroy the pathogenic bacteria or the disease-producing germs that are being consumed virtually by the non-pathogenic bacteria. He takes pebbles of various sizes with a layer of water on them, the water is proportionate to the size of the pebbles, and the purifying property to the surface is in inverse proportion to the size of the surface over which the water is spread. In these filtering-basins he makes the stream of water pass from one basin to another as fast as possible in order to know just what he is doing. The problem then is that of distributing water over a small surface, so that the bacteria can have access in the presence of atmosphere. Mr. Mills shows conclusively that a body of water underground, out of the presence of atmosphere, is not purified, because the purifying bacteria cannot work in the absence of atmospheric air. They need air for their existence. He shows that the passage of a stream of water so far underground that the air does not reach it, is not benefited at all; that it possesses organic impurities. This explains why wells are contaminated by cesspools. It seems to me that the result of the researches of others, so ably recounted by Mr. Mills, are the basis upon which we must go, and that the water-works company in Omaha have practically concluded that the step necessary to complete the purification of our water is the establishment, in addition to filtering-basins, of large filtering-areas of fine pebbles, or possibly of sand.

Dr. Ames.—This is an extremely interesting subject—the pollution of

water, its filtration, etc. We have been working on the mechanical filtration of water for nearly a year, and the results we claim indicate that while filtration benefits and purifies water, there is no process of filtration that will entirely remove the micro-organisms or germs in it, no matter how slow or how rapid it may be. You cannot remove the small spores by the finest material you use. You take, for instance, the germ-filterer of Pasteur: it is not a true germ-filterer, because you can get under the most favorable circumstances satisfactory cultures. Sand-filtration removes ninety-nine per cent. of the spores and bacteria. Our results were about the same, up to ninety-eight per cent. of the cultivatable germs on the ordinary culture media. I think the fineness has a great deal to do with the process of filtering. The question we are interested in is, Is it not possible to use a mechanical instead of the ordinary one, to do away with depth, and let the mechanical filter take the place of the ordinary filter? While there are many objections to the filtering-jars, such as are used in Europe, you can handle any amount of water with them. It is always under the control of the filter, and the quantity varies from one to sixteen millions gallons. It gives you beautiful water.

The report of the Massachusetts State Board of Health is the classical work of to-day on the subject of water-supply and the management of sewers; still they have not reached a positive point yet in regard to the atmosphere and purification of water. They are working in the right direction, and next year they may be able to give us definite results. Their process does reduce the albuminate of ammonia; it diminishes the nitrates and the floating organic matter; but without a precipitant or coagulant the finer particles will not be removed. You cannot remove them without using a coagulant.

Dr. Delos Fall, of Albion, Michigan.—It seems to me a great deal is illustrated by our experience with the Calumet and Hecla Company in upper Michigan. Here is a population of 12,000 people in the employ of the great copper-mining company. Eleven thousand people are under the control of this company, living in houses constructed and owned, and cared for in every way, by the company. There are one thousand people incorporated in the village of Calumet, which lies in the heart of the crowded population. The Calumet Company, with a liberality that is unusual on the part of large corporations like it, at an expense of a half million dollars, brought water from Lake Superior, a distance of seven miles, up a grade of seven hundred feet, and supplied every house under their control with pure water. Out of a thousand people who largely drank water from wells last year in this village, there were fifty-one cases of typhoid fever. In the territory surrounding it, with its 11,000 people, there were but eighteen cases of the disease. You see the ratio existing between the cases of typhoid fever as between those who used Lake Superior water and those who use well-water, would be about eighteen to eleven times fifty-one.

Dr. Henry B. Horlbeck, of Charleston, S. C., presented a report on

"Vital Statistics of the South," and introduced the following resolution, which was handed over to the Executive Committee without discussion:

CHARLESTON, S. C., October 10, 1891.

Gentlemen: I have the honor to engage your attention to a subject which is of great interest to all of our cities in the South, where a considerable part of the population is of the colored race. It assumes in Charleston an interest of great magnitude, as the colored race outnumbers the white race.

We are prepared to show by the following statistics that in all of the cities noted the ratio of mortality among the colored race exceeds that of the white race. In some cases it is not so great; in others it reaches the proportion of double the ratio of black to white. In referring to the annual report of the city of Charleston for the year 1890 we find that ratio as follows: Ratio per 1,000 in the year,—whites, 17.70; black and colored, 36.93;—total, 27.94. In comparing the reports for ten years, from 1880 to 1890, we find the ratio among the whites to be 21.39, and that of the black and colored to be 43.66,—more than double. In Washington for fifteen years, from 1876 to 1890, the white ratio has been,—white, 18.40; colored, 33.60. In Nashville for sixteen years, from 1875 to 1890,—white, 17.91; colored, 32.30. In St. Louis, 1880 to 1890,—white, 19.02; colored, 34.16. In New Orleans, 1881 to 1890,—white, 23.73; colored, 37.87. In Mobile, 1876 to 1890,—white 22.68; colored, 28.73. In Memphis, 1876 to 1890,—white, 23.32; colored, 29.03. It will be seen that in every case the ratio among the colored and black race far outnumbers the white.

The only publication in reference to these matters that I am aware of in the United States, is from the office of the United States Marine Hospital Service. In their abstract, issued March 13 last, I find that the death-rate of Charleston is placed at 32.4. We claim a death-rate for the same period, total white and black, of 27.94. This is due to a different table of population. Such figures given to the world at large, would indicate that Charleston is one of the unhealthiest cities in this country. Such is not the case,—at least among the whites. For the year 1890 we claim, with the population as taken carefully by local parties, a death-rate of 17.70. With such a death-rate among the whites it is manifestly unjust for us to be classed among the most unhealthy cities.

The press of the country published without explanation the heavy death-rate, as given by the United States Marine Hospital Service to the *New York World*. The United States Marine Hospital Service has continuously refrained from publishing the ratio of deaths among the white and black races in separate columns,[1] and I deem it a matter of the greatest importance that these facts should be given to the public in their fullest significance; and in furtherance of this view of the matter I would offer the following resolution:

Resolved, That the American Public Health Association call to the attention of the supervising surgeon-general of the United States Marine Hospital Service the great importance of giving to the American public a complete table of the mortality statistics of the United States, both as to the white race and as to the colored race;

Resolved, That the said surgeon be requested to have the statistics of the white and colored races published in separate columns.

Adopted.

On motion of Dr. Hibberd, the Association adjourned till the evening.

[1] Read letter to United States Marine Hospital Service, page 143, March 27, 1891.

EVENING SESSION.—8 O'CLOCK.

The Association was called to order at 8 p. m. by Dr. E. R. Lewis, of Kansas City, chairman of the Committee of Arrangements, who said,—

Ladies and Gentlemen: It has been the custom of this Association, in years gone by, that the chairman of the local Committee of Arrrangements the first evening should make an address on behalf of that committee, welcoming the delegates to the place of meeting. Such a thing is out of the question to-night, for several reasons which I shall not mention.

The Rev. J. J. Tigert then offered prayer, after which Dr. Lewis introduced in a few timely words Governor David R. Francis, of Missouri, who delivered an address of welcome. (See page 14.)

Dr. Lewis.—It is with extreme pleasure that I introduce to you our generous friend just across the street, Governor Humphrey, of Kansas.

Governor Humphrey then spoke as follows (see page 17):

Dr. Lewis.—Owing to the death of a member in Major Holmes's family a few hours ago, the Hon. John L. Peak will represent him in welcoming you to Kansas City.

The Hon. John L. Peak was received with applause, and, when quiet was restored, spoke as follows (see page 21):

Dr. Lewis.—Having heard three able addresses from different parties, we will now proceed to the address of the President, Dr. Montizambert, of Quebec.

Dr. Montizambert then delivered the annual address of the President. (See page 1.)

SECOND DAY.

Wednesday, October 21, 1891.

MORNING SESSION.—11 O'CLOCK.

The Association was called to order at 11 a. m. by the President.

The President.—We will first listen to announcements by the chairman of the Committee of Arrangements, Dr. Lewis.

Dr. Lewis.—There are no announcements to make, Mr. President, in addition to those that have already been made, with the exception that the railroad company want to know how many wish to go on the excursion to-morrow afternoon. If any member will suggest how best we can find out the number, I would like to have him do so. The ride will consume about three hours and a half, and we shall return in ample time for supper and the entertainment to be given the Association by the Commercial Club in the evening. If it is agreeable to the President, I will ask those who are present and intend to go to stand up.

Dr. ———.—I would suggest that those who contemplate going hand

in their names to the Secretary or to the chairman of the Committee of Arrangements, and that the number be made up in this way.

This was done.

THE PRESIDENT.—We will now listen to reports from the Executive Committee.

THE SECRETARY.—The Executive Committee, to whom was referred the resolution of Dr. Reed, recommend the adoption of the same.

The resolution was adopted.

THE SECRETARY.—The Executive Committee also recommend the adoption of the resolutions offered by Dr. Horlbeck yesterday.

On motion, the resolutions were adopted.

THE SECRETARY.—Mr. President, the Executive Committee recommend the following gentlemen for membership in the Association (names read):

On motion, the Secretary was instructed to cast the vote of the Association for the applicants whose names he had read, which he did, and they were declared duly elected.

The President then called the roll of the Advisory Council.

DR. PERKINS.—The committee to whom was referred the Treasurer's report yesterday is now ready to make its report.

DR. REED.—We have examined the Treasurer's report, bills and vouchers connected therewith, and find the same correct.

On motion, the report of the committee was adopted.

THE PRESIDENT.—We will now listen to a paper by Dr. Paul Paquin, of Battle Creek, Michigan, entitled "Vaccine and Vaccination." (See page 171.)

DR. CHARLES N. HEWITT, of Minnesota.—How long after the introduction of the virus do you remove it?

DR. PAQUIN.—It depends a great deal upon the time—five or six days sometimes, but on an average about the sixth day. We have to judge by the nature of the scab.

DR. R. HARVEY REED.—There is one important point brought out in the paper, and that is the fact of compelling parties who furnish us with vaccine virus to register their names and number, so that we may know where it comes from and trace it to the particular animal. In our state we have been greatly annoyed by vaccine virus, and firms send it to us without any number on it, date, or method of tracing it. We could not tell whether it was fresh or not. The state board of health has complained very much in reference to the results, and their complaint is based upon the complaints of the health officers.

I found, a few years ago, when vaccinating the children of the schools in our city prior to a little scare of small-pox, that it was impossible to find any firm that registered and numbered their vaccine. In skirmishing about for vaccine I got hold of some from a firm in Chicago which was very good. I kept a registry of every one of the children I vaccinated, the time vaccinated, the kind of virus used, and a record of the virus

afterwards, whether it took or not, the nature of the trouble following it, if any, etc. Many of the firms put a glycerine preparation in it to keep the vaccine moist and fresh, and when we tried it, many cases would not take at all. When they did take, the children would have bad arms. The parents were opposed to having their children vaccinated because of the bad results. After we obtained a registry of the virus we had no trouble worth speaking of in the vaccinations.

DR. HEWITT.—The popular view drawn from the paper presented, and the position which vaccination occupies as a sanitary measure in this country, seem to warrant more justification than there appears a disposition on the part of the members of the Association to give to the subject.

I will consume a few minutes in telling you our experience in Minnesota. We have had during the last eighteen years (the early part) several violent outbreaks of small-pox. It is only by the persistent use of vaccination, isolation, and strict intervention that we have succeeded in making the disease a rarity. In pursuing our investigations we found that a large proportion of the school children were not vaccinated at all. I wish all the other states would make a similar investigation in this regard. I believe the profession is laboring under gross misapprehension, passing opinions upon what was, and not what is. In our state we have 60 per cent. that were never vaccinated, and if this be true of school children, what must it be in the case of the younger children, those under five years of age? For the purpose of meeting the objections raised against vaccination by the non-professional following, and the introduction of vaccine products into commerce, we have been making a special study of the matter. I went abroad two years ago to look up the subject. I went all over the vaccine stations in Europe, and studied it under the masters there. The vaccine was purchased from the National Vaccine Company, London. The inference drawn from the paper is, that a small number of vaccinations are followed by dangerous results. The vaccine I brought from England I introduced into calves before I distributed it over the state. I have vaccinated one thousand children in the town where I live. First, I tried it upon myself, then upon other gentlemen who submitted to it, and we found out that we had the vaccine we wanted. I then proceeded to offer it to the school children. I kept a careful record of the vaccinations, amounting to over one thousand, directly from the calf. The children came out to the station, one or two hundred of them, and I got 98 per cent. of successes.

In the one thousand cases I did not get an unfavorable result of any sort. There was one case of eczema which followed the operation, and I was told that that child had had the itch ever since it was born, so that the history of eczema in this particular case was clear. No other cutaneous eruption followed, nor any unpleasant results even in adults. The number of adults vaccinated amounted to one or two hundred. If the profession will realize the fact, it is possible for us to have an epidemic now, the same as we used to. If we do not recognize the simple and

ingenious measures for relief, you and I will be the responsible parties. It is a matter of business for us to see that pure vaccine is introduced. Every one of the state boards of health should see to it. It is a comparatively inexpensive measure, and we can then watch its operation. Everything used should be reported to the officer in charge, so that if the slightest thing occurs we shall be able to trace it to its source. By our works they shall know us, and that is the way we ought to be known. The road to safety is plain, if we will only take it.

Dr. Jesi, of Mexico.—The subject under consideration is one of great importance. I desire to say a word or two in regard to the way we work in Mexico with respect to vaccination. As has been stated, there is great importance to be attached to the origin of the vaccine. In Mexico we do not know animal vaccine. We do not have such fine cultures as you have here. We use altogether human vaccine, and that regularly in accordance with our laws. The government laws in Mexico make vaccination obligatory. Doctors are appointed to do nothing else but to vaccinate people, and the vaccine is taken from the human subject. We find that human vaccine in modified form is more efficient, and a greater protective than the animal virus. Much depends upon the intelligence and aptitude of the men employed to do this work. I have two assistants who collect vaccine from the best and healthiest children in the country, which is put in closed capillary tubes and hermetically sealed, thus preventing decomposition of the vaccine, and every third day, according to our law, all the children of any town or city must present themselves to such physicians and are inoculated free of charge. On the fifth day the child is brought back to see whether it took or not. If it be observed that the vaccine took, the children come later to get vaccine out for other children in the future, and in this way they have a constant supply on hand. We can say now that epidemics of small-pox in Mexico are unknown. We have what you call sporadic cases, a few isolated cases, but no epidemics such as we used to have twenty-five years ago.

I do not think we should strive hard to protect the patrons of any vaccine firm; we should leave the trade free; but let the doctors be careful in keeping, getting, and cultivating vaccine, and begin to use human vaccine in its modified form, which I think is far superior to animal vaccine. There is no difference, physiologically or otherwise, from the animal or from the man, and why should we make use of an original animal substance when we can cultivate it in the human system. You will find, my friends, if you give the matter more attention and cultivate human vaccine, that you will prefer it to animal vaccine. Our success is not altogether dependent upon the vaccine from the cow or calf, but it is dependent upon the diligent management of the doctors in charge of the cases.

Dr. L. F. Salomon, of Louisiana.—I fully appreciate what Dr. Hewitt has said, and I agree with him thoroughly, that the accidents which follow vaccinations are not so frequent as the author of the paper would lead us to suppose, and we are not unacquainted with the practical employment

of vaccine in Louisiana. We enforce there compulsory vaccination, as far as possible. We require that every child before it is admitted into school shall show a certificate, either from the sanitary officer or from a reputable physician, to the effect that it has been successfully vaccinated. In that way we secure protection. We have tried vaccine from different firms in the United States, and I do not care to particularize. I do not care to advertise any particular vaccine firm, but there is one firm we get our vaccine supply from, I am free to confess, whose vaccine is as pure as you can buy anywhere. With it we find that over ninety per cent. of our first vaccinations are successful, and a very large number of our secondary vaccinations are likewise successful. In the second place, a careful record is kept of all children vaccinated by the sanitary officers, and we request physicians to report the results of the vaccinations; and we find few, if any, accidents resulting from the employment of bovine virus. It is rare that a case is reported, and when one is, it is generally due to the individual vaccinated rather than to the vaccine.

In regard to the remarks of the gentleman from Mexico [Dr. Jesi], it is well to say that we, in this country, have thoroughly tested the plan of propagating humanized vaccine, and have come to the conclusion that we would best stick to what we now have,—that is, of using bovine virus,—simply because with the utmost care it is not always certain that humanized vaccine is pure and not liable to contaminate children who are vaccinated with it. When we know the vaccine is from a reliable vaccine firm,—pure, and carefully collected, and we are careful in our vaccinations,—I do not think any harm will result to the children who are vaccinated. We get, in my opinion, much better results and a better guaranty of protection.

Dr. Hewitt.—An interesting point occurs to me. When I was in Ireland some of the vaccine they were using there was a lineal descendant from the Jennerian vaccine. I saw it in the local government board office. It was from the vaccine sent by Jenner to the Board of Health of Dublin in 1800, and the results were as good as one could possibly wish.

Dr. Ames.—A word with regard to the best method for keeping vaccine virus. We have great trouble in the navy, particularly at the Asiatic stations, in securing good vaccine virus that will keep. It appears to lose its strength in a short time by the most rapid method of transmission. We have had trouble with it in Canton, where we had an outbreak. There was no vaccine there, either from the human or the animal subject. We had to telegraph to Japan for it, and found that the results were extremely meagre. Complaint was made along the whole coast of the English and foreign settlements of the coast, that the virus which was sent *via* the Suez canal was bad, and that which was sent from the United States across the Pacific coast caused considerable trouble. The Japanese government started a firm or a place where bovine virus could be secured. This is not satisfactory. I would like to know whether there is any special way in which it can be kept sufficiently long to accomplish what we desire with it.

Dr. Paul Paquin.—Vaccine virus is exceedingly sensitive, and dies quickly at a warm or moist temperature. If carried in the vest pocket it is destroyed in a short time. The best method, so far as I know, is to keep it in a cool place, if possible, then use lime in the bottom of the dish or jar in which the vaccine is. The lime absorbs the moisture, and the vaccine remains cool. In this way I have been able to keep it a year. As a rule, with the ordinary method it will not keep longer than three or four weeks. A good deal depends, too, upon the animal from which it was taken. Successive generations in a young calf may last for several months, and then die quickly, although it is weaker than some vaccine taken from the cow.

Dr. Clarke Gapen.—Last winter I had a rather peculiar experience with vaccination. I provided a large number of points for vaccinating in nearly every instance, and in one case there was considerable febrile disturbance, the temperature rising as high as 102°. The eruption resembled varicella. I inquired of a gentleman, who is an eminent bacteriologist, whether that was due to the superior quality of the vaccine. The eruption was not so profuse as is ordinarily seen in varicella, but similar in kind. He could not tell me. I would like to ask some one who is well informed on the subject to state whether he thinks the fever was due to the superior vaccine used.

Dr. Hewitt.—I think I can answer the question of the gentleman. There was nothing but an unfavorable connection between the eruption and vesication. It is a vesicle, not a pustule. The vesicle is attended with a little erythematous rash over the body generally. I think that it is not an uncommon experience. Anything in the way of a vesicular or pustular eruption is not considered legitimate or good.

As to the preservation of vaccine, I saw some of the experiments of Dr. Cory while I was in London. He uses the vaccine virus from calves in preference to any other. He has experimented with all kinds of vaccine. Every time he inoculates a series of calves, he saves a portion of the pure virus, which is put into a capillary tube with a bulb in the middle of it, the vaccine being stored in the operating-room. I saw vaccine there two years old in these tubes. His results with it were perfect. My impression is, that a temperature of about 40° is the proper one for preserving vaccine virus. If it is going to be preserved for any length of time, it should be preserved in sterilized tubes collected from the vesicle and sealed directly. That being done, it may be kept for a long time.

Dr. Jesi.—I am requested to say for Drs. Jesus Chico and Jesus Monjaras, that if the vaccine virus is pure, they have seen no bad results from its use. Dr. Monjaras thinks that human vaccine in its modified form has a tendency to cause recurrence after a year, and that, by repeated vaccination from time to time, danger is avoided.

Another Mexican gentleman thinks the contrary, that human vaccine is so powerful that we hardly ever are called upon to repeat the operation of vaccination. He believes it will preserve for life.

A gentleman tells me, who comes from S. Luis Potasí, France, that human vaccine should not be used on account of the many dangers attending its use, such as syphilis and other infectious diseases, and that vaccine from the cow should be used instead. He has established a firm in France, which he expects to carry on for this purpose. I hope he will change his ideas and resort to human vaccine, which, according to my observation, is more efficient and less dangerous than animal vaccine.

Dr. J. N. McCormack.—I move that the subject be passed, and that we proceed to the next order on the programme.

Dr. J. D. Plunket.—Before that motion is put, Mr. President, I would like to ask the gentleman from Battle Creek [Dr. Paquin], who seems to know a good deal about this subject, a question. A good deal of objection has been raised in certain quarters as to the possibility of contamination both from bovine and humanized virus, as, for instance, syphilis or tuberculosis. Some experiments of a very positive character have been made in France upon the goat, and the statement is emphatically made that the goat can neither be syphilized nor tubercularized. The suggestion is offered as to whether the goat would not be the proper animal to propagate virus. I would like to know whether the gentleman has had any experience in that direction.

Dr. Paquin.—I have never used goat virus.

Dr. McCormack's motion was then put by the President and carried.

Mr. Robert Gayol, C. E., and engineer of the National Board of Health of Mexico, read a paper entitled "The Drainage of Mexico City." (See page 53.)

Dr. Peter H. Bryce.—In rising to discuss this paper, I think I am only expressing the views of the Association in saying that it affords all of us extreme pleasure to receive a paper from one who has been—though laboring under more or less embarrassment and difficulty—able to express in the English language in terms so clear the principles of sewerage as applied to the City of Mexico. He has explained to us its difficulties from the stand-point of engineering, and has set forth scientific principles with which to overcome their intricacy. He has presented to us the most modern principles of sewerage construction, as we have seen it developed on this continent and in Europe. There is no one point, so far as I recollect, that he has overlooked. He has taken into consideration, first, the amount of sewerage to be carried, and likewise the limited amount of water, etc. I think the Association is to be congratulated on having such a paper presented to it.

The President.—If there is no further discussion, I will call for the reading of the report of the Committee on the Disposal of Waste and Garbage, Prof. Delos Fall, of Albion, Mich., chairman. (See page 90.)

Prof. Fall then read a portion of the report, the balance being read by Dr. Edward Clark, Col. W. F. Morse, and Mr. Crosby Gray, of Pittsburgh, Pa.

The President.—The discussion on this report is now in order.

A MEMBER.—As the time has arrived for adjournment, I move that we do now adjourn.

Motion seconded and carried.

EVENING SESSION—8 O'CLOCK.

The Association was called to order by the President at 8 p. m.

Dr. J. J. Kinyoun, Passed Assistant Surgeon United States Marine Hospital Service, read a paper on "Rabies." (See page 162.)

Dr. Ernest S. Dundas, United States Veterinary Inspector, of Kansas City, read a paper on "Animal Diseases." (See page 169.)

DR. ———.—The state of Missouri has a law which says that all animals or people suffering from contagious diseases shall be quarantined, and there kept until they are either well, or disposed of otherwise.

The essayist spoke of the Jersey cow as being more prone or susceptible to tuberculosis than any other animal. I do not see why that can be. The disease may be hereditary, or it may be communicated in several ways through the lacteal fluid. When the expectoration dries up and floats in the air any one is liable to become contaminated with the tubercle bacilli, and when the sanitarian takes charge of the human being, then it is time to look after the animal, because, where we have one animal affected with tuberculosis, we have fifty cases in the human family.

DR. HIBBERD.—I would like to ask the author of the paper if I understood him correctly, that the Jersey cow is more commonly the victim of tuberculosis than any other race of cattle. I will ask the additional questions, Upon what evidence do your conclusions rest? Is it simply public sentiment, or the result of your personal observation in regard to the matter? All over this country—and in my neighborhood particularly—we glorify the milk of the Jersey cow; and if it be true that it is more frequently the subject of tuberculosis, and that it is more liable to transmit the disease to us through its milk, it is well that we should cut down our glorification and go back to the old breeds and get wholesome milk. Is there any substantial foundation for the statements that have been made?

DR. DUNDAS.—I take my authority from personal observation. In my inspection of cattle, I have found this disease [tuberculosis] especially among the Jersey cattle, and I understand that statistics show that both tuberculosis and pleuro-pneumonia have originally arisen from that class of cattle.

DR. AMES.—Dr. Brush, of New York, has written an article on the tendency of tuberculosis among Jersey cattle, and in it he says it is well known that they have a marked tendency towards tuberculosis, which he accounts for on the ground of their being high or inbred. Among the equine breed there seems to be a greater tendency toward the development of tubercular trouble. I simply mention this. I cannot recall the date of the article, but it appeared in the New York *Medical Record* some eighteen months ago.

Dr. Salomon.—It would seem, in connection with the paper just read, that the question of the most practical importance is in regard to meat inspection and the inspection of animal food before it is delivered for consumption. That is something at this moment that I am particularly interested in, and I would like to ask the gentleman to give us in detail, in as few words as possible, what constitutes a thorough inspection of animal food or dressed meat. I would like to know the manner in which the inspection is made,—whether all cattle that are slaughtered are inspected before delivered to the consumer, or whether a microscopical examination of the liver and lungs is made after slaughtering; in other words, what precautions are taken to prevent diseased meat being delivered to the consumer. That is, in my opinion, the most practical question connected with this subject. After the removal of the lungs and liver from an animal that has been slaughtered, I would like to know what constitutes the diagnostic sign by which the inspector of cattle knows that an animal has tuberculosis. I would like to arrive at something practical in regard to this very important subject. The State Board of Health of Louisiana is engaged in this subject of dressed meat inspection.

Dr. Dundas.—The mode of meat inspection, as carried on by the department of agriculture, is not allowed to be published. These are my orders. I have been asked not to read this paper, for the reason that the Bureau of Animal Industry gave instructions not to reveal the mode of inspection of meat. If any of you wish to see our packing-houses, come down and I will show you how we carry on our inspection.

Dr. Bryce.—We cannot spend our time more profitably than in continuing this discussion. It has been demonstrated by experimentation, in the laboratories of Berlin and elsewhere, that from five to ten per cent. of all the animals which are killed in those countries are tuberculous. This being the case, one out of every twenty animals fed in those and this country are tuberculous; and it forces upon us the practical question, How are we going to defend ourselves, as Dr. Salomon has said, against the dangers of tuberculous meat? Or, indeed, are there any dangers from tuberbulous meat? It is well known that the lungs and certain other portions of animals are readily discovered as being tuberculous. It has not been generally known that the muscles and those other portions of the body which constitute our meat supply are tuberculous. Some, certainly, are not known to be. Is there any way by which the inspector of meat can tell whether such meat is wholesome for food or not?

In the last report of the Department of Agriculture for Great Britain, Professor Crowl, the head of that department, had not been able to settle this question from the tissues of animals whose lungs were supposed to be tuberculous. They endeavored to find out whether the meat itself was tuberculous by selecting portions of muscles, which, by the aid of the microscope, were found to show neither tuberculosis nor even the presence of tubercle bacilli. They took portions of the meat and the juice of

the meat, and, mixing these with bread, fed the mixture to rabbits and guinea-pigs. The report states that at the end of three months, under two different sets of experiments, seventy-five per cent. of the small animals became tuberculous from eating tissues in which the bacillus or germ of tuberculosis was not to be found by the microscope. It would seem that if these conclusions be true it would be sufficient, when an animal is found to be tuberculous on inspection, to condemn the whole carcass, no matter whether bacilli were found or not.

The gentleman who read the paper did not go into this question as fully as I wish he had done,—that is, with regard to the possibility of our knowing whether animals or milch cows which are tuberculous can be proved to be so or not. I have endeavored, as the health officer of a Canadian province with a laboratory to work in, to find out as much as possible the facts regarding this matter. When can we tell that a cow is tuberculous? Of course, when a cow begins to fail in health the veterinary inspector would have little or no difficulty in knowing that the animal is sick; but we, as consumers of milk, feel that we are not being protected in any great degree in this particular matter.

With regard to the fact of one class of cows being more liable to tuberculosis than others, I have understood it to be true, and the reasons are tenable, that the Jersey cows and all others closely inbred are more liable to tuberculosis than those that are fed outside. The same is true of people who work in factories and of those engaged in in-door pursuits: they are more liable to tuberculosis. For that reason, I am sure it is desirable to keep selecting new animals and never breed cows while they supply milk to our cities. I am aware that there are some large dairies in our country in which this system is practised. A good healthy, large country cow sometimes gets into the city market, is put into a stall and fed as long as she gives milk, and then goes to the butcher. This should be carried out everywhere under the supervision of health officers having charge of this particular matter. It seems to me that if we can establish in every municipality a systematic, periodic inspection of milch cows once a year, or once a month, as the case may be, where dairymen are bringing in new cattle every week, we will practically do away with the danger of tuberculous milk-supplies to our cities.

Dr. Reed.—The question brought up by my friend from the South, Dr. Salomon, with reference to the inspection of meat, is equally as important to the people of this country as that of the inspection of milch cows.

The gentleman who read the paper says he has no right to reveal to us how inspection is carried on, that he simply is carrying out the orders of his superiors; yet at the same time, as this is a question that pertains to the public, it is perfectly right that they should know a little something about the kind of meat they are eating.

Those of you who were with us on our tour of inspection this morning, which lasted only a few hours, observed the practical manner in which meat was inspected. I was told by one of the authorities that a certain

slaughter-house ships about three thousand animals every twenty-four hours. When we consider the fact that there are only twenty-two microscopists, who examine two specimens from each of these animals and have but two days to make their report, and that there are three thousand animals being killed daily, if the microscopical examination is reliable it is beyond my comprehension. I admit that the government is right in this direction, but these places are not supplied with enough microscopists to make us feel that we are free, and that the meat we receive from slaughter-houses is free from danger of disease. I was told by one of the authorities that the part inspected by the microscopist was a portion of the diaphragm and some other portion of the body. They look out for the different micro-organisms, but principally for the tubercle bacilli. These two pieces of meat are put in a little tin box, and in this box are put two numbers corresponding with each other, one with a little tag on it, and the other stuck on the meat. These numbers are known to the microscopists who make the examinations. The animal is then put in the killing-room, and the parties who look after the report must hunt the animals up in case they are found tuberculous. Gentlemen, imagine twenty-two men working on three thousand animals killed daily, making a scientific, reliable microscopical examination! I tell you that it is just as impossible as it would be for a man to fly to the moon. Now, this thing obtains in the East and South and other parts of the country. We have got to depend upon these people for our supply of meat, and we have a right to demand of the government, who take this matter in hand, that they make a full and competent microscopical examination of these animals—an examination that we can rely on. Of course, we shall have to pay for it, but when we pay for it we should get it.

Dr. Dundas.—Dr. Reed makes a mistake. Only about 800 head of cattle are examined daily, which includes hogs.

Dr. Reed.—I would like to ask whether the beef is inspected at all?

Dr. Dundas.—Yes, it is.

Dr. Domingo Orvañanos, member of the Supreme Board of Health of Mexico, read a paper entitled "New Organization of the Supreme Board of Health of the Mexican Republic." (See page 38.)

Dr. Remondino.—It is with pleasure that I have listened to the report of progress being made in our sister republic, and I only regret that I cannot say as much for our own country. We know that the moral and mental welfare of men depends upon their physical welfare. It seems natural that the government should take some steps towards general sanitary improvements affecting the whole country, each state being ready to act for itself. In some states we have good laws; in others we have virtually none regarding the matter under consideration. I take it that the greatest trouble under which we labor in this country at present is the matter of medical education. I do not believe we can ever have any sanitary legislation until we have a united profession. We shall never have a united profession so long as the code of the American Medical Association is as

exclusive in the matter of consultations and fraternization as it is. There are a great many men who will keep out of the profession, who should be in it. For instance, my preceptor was a graduate of Jefferson Medical College. He was our family physician. His son became a homoeopath. Now, there are a great many homoeopaths whom we would like perhaps to consult with, and who practise as intelligently as some of us do; but at the same time we cannot consult with them. We are obliged to say, "Doctor, I recognize you as a rational, intelligent physician, but I cannot associate with you professionally, for if I do my fellow-physicians will not associate with me." When we ask for medical legislation, this is one of the first things that stands in our way. It is a stumbling-block to legislation. If we do away with such a restriction, how much better it would be for the profession, and how much sooner would we have legislation tending towards better sanitary regulations for the whole nation?

Dr. Henry B. Baker.—I rise to express my pleasure and gratification at hearing such an able paper. I am glad to know that in Mexico they have such a thorough organization. I wish some one could get up and truthfully describe such a system for the United States of America. I hope that some day we shall be able to go to Mexico and describe to them truthfully as good a system for our country.

Professor Daniells.—I call the attention of Dr. Baker to the constitution of the United States,—that each state has its own laws: we cannot establish laws for the state of Missouri or any other state.

Dr. Hibberd.—There is an effort being made to bring the matter to the attention of the government. I do not know whether it is really in the line of appropriate action for this Association to give any attention to that effort or not, but at the last meeting of the American Medical Association there was a resolution unanimously passed instructing the committee to prepare a petition to be submitted to the government of the United States to establish a cabinet officer who shall be styled the Secretary of Public Health. Now, when that shall have been perfected and a cabinet officer nominated and confirmed, we shall have a national institution which will have the general supervision of the health of the whole country. I am not sure that the movement is far enough along, or that it would be deemed appropriate by this Association, to give any encouragement to that effort. I think, however, that it would have some influence in bringing about a proper consideration of the subject.

Dr. Baker.—I would like to say a few words in addition to what I have previously said, although I dislike to differ with Professor Daniells on this question. I am not a lawyer. What I intended to convey was this, that I hoped we might have as good a system as has been described for Mexico in the United States at no distant date, and I believe the government of the United States is able to cope with this matter. It needs to be brought to the attention of congress. As was said by one of the governors [Humphrey], nothing more important to the general welfare can be conceived of, than the protection of the public health. I think the

United States is able, when it is willing, to provide a proper national health service, and I want to express again the hope that it may be done soon.

Dr. Hewitt.—The history of national health legislation in this country has been the cause of more trouble in the Association than any other question that has been brought before it. We want to let it alone; the thing is working out its own salvation, and the less we have to do in the way of official action the better. The national legislation has got to be in the direction of improvements. Some gentlemen doubtless forget that a national board of health is in existence in this country, comprising the health officers of the different states; that we must do this, that, and the other thing. There are gentlemen sitting here to-day who voted at the beck and call of the national association; there are others who dared to put into operation what the national board thought not to be right, and bluffed them. We do not want to meddle with it at all. The example of Mexico does not apply to us. The states in this country have got to work out their own salvation.

Dr. McCormack.—In expressing that opinion, I am sure Dr. Hewitt, from conversations I have had with him, does not give his individual opinion. I feel equally sure that he does not express the opinion of the majority of the members of the Association, or the majority of the members of the state boards of health of this Union. A large number of us have been engaged in trying to secure a central health authority at Washington, which would be the means of communicating between various state organizations, without interfering with the work of the states, facts in regard to sickness and death. I believe that there is very little difference of opinion as to the expediency of the organization of a bureau, or board, of this kind under the auspices of the general government. It is work that can be done only by the general government. It cannot be done by the state boards of health.

I express my gratification at the perfection to which this matter has been carried in Mexico. I want also to endorse the sentiments that I have heard expressed by Dr. Baker, and to express the hope that the time may soon come when we shall have a central organization of this kind at Washington. I have nothing to do with the mistakes of the old National Board of Health. I regret the occurrence of such mistakes; but we have grown older and wiser, and I feel sure that the establishment of a service of this kind, which is now being attempted by the American Medical Association, will be of great benefit to us.

Dr. W. L. Schenck, of Osage City, Kansas.—I was interested in the report of our young sister republic. We are here as sanitarians, not only from the United States but elsewhere, to discuss sanitary interests, and I agree with my friend who expressed himself so well, that the general government can conceive of nothing greater than the protection of the life and health of the people of this great country, and that if the national and local boards of health will coöperate in the matter, the establishment

of a general supervision of the health of the people, which we are here to discuss and seek to advance, may be brought about.

DR. PLUNKET.—The discussion has somewhat surprised me because of the fact that we have a standing committee on this subject. I am a member of that committee. We have not made our report to the Association; still, I have in my pocket a communication from the chairman of our committee, and when it is called for, we shall be ready to introduce the subject. I would like to ask the chairman whether it would be in order to have the letter read if this subject is under consideration.

THE PRESIDENT.—I desire to say to Dr. Plunket, that this discussion has been a little out of order. Of course gentlemen understand that more or less latitude is given them in the discussions. The health of Mexico, technically speaking, was the subject of the paper, and I think it would be proper to postpone any further discussion until the report of the committee of which Dr. Plunket is a member comes up, and then further remarks will be in order.

Dr. Geo. Homan, of St. Louis, Mo., read a paper entitled "Land Liberation as a Public Health Measure." (See page 80.)

DR. JESI.—I desire to say a few words on the paper that has just been read. I will say in behalf of Mexico that by its sanitary code the Mexican republic is not only in duty bound to protect the life and property of its citizens, but also the health of the people, which is the principal happiness of a nation. I am an American citizen, and a graduate of an American medical school, and I stick to the American nation, yet I am constrained to say that the Americans can bring their influence to bear upon the government as to the enactment of certain laws to protect the people from many of the evils which afflict the United States—I am speaking now as an American citizen. We in Mexico protect the people from quackery and empiricism, protect them from adulteration of food products, protect them from the abuses of tenement-houses and of landlords—in short, everything is watched by the government. Why? Because the government realizes that it is its duty to protect the health and happiness of the nation. I hope these conventions, wherever they go, will point out the importance of hygiene. In this way we shall grow in the hearts of the educated people, and we shall have some influence upon the rulers and law-makers of the country, so that the people will have laws which eventually will make them healthy and happy.

On motion, the Association adjourned until 9 o'clock, Thursday morning, October 22.

THIRD DAY.

THURSDAY, October 22, 1891.

MORNING SESSION.—9 O'CLOCK.

The Association was called to order by the President at 9 a. m.

THE PRESIDENT.—We will listen to some announcements from the chairman of the Committee of Arrangements, Dr. Lewis.

DR. LEWIS.—I am requested by Mr. G. F. Putnam, President of the Commercial Club, who expected to be here with us this morning, to call the attention of the members to the fact that the Commercial Club will be glad to receive them at 8 p. m. at the Commercial Exchange.

The railroad excursion this afternoon will start from the Union depot at 2:30. The members of the Reception and Entertainment committees are expected to be at the depot to receive the delegates and place them on the train.

THE PRESIDENT.—The next thing in order is the election of new members.

SECRETARY WATSON.—The names of the following gentlemen have been recommended for membership in the Association (see list):

DR. PLUNKET.—I move that the Secretary be instructed to cast the ballot of the Association for the election of the gentlemen whose names have been read.

THE PRESIDENT.—If there is no objection, that course will be taken.

There being no objection, the Secretary cast the ballot, and they were declared duly elected.

MR. HENRY A. FLEISCHMAN, of New York city.—I desire to call the attention of the Association to the fact, that yesterday there was no discussion on the report of the committee regarding "The Disposal of Garbage and Waste." I would like to make a motion, if in order, to the effect that that discussion be taken up now, before any other paper is read. And in support of this motion, I will say that a great many members came thousands of miles for the express purpose of hearing something on that important subject. Mr. President, it would be a great injustice, seeing every other paper has been discussed, to pass this important report without discussion. I make a motion to take it up, at the disposal of the President.

THE PRESIDENT.—We must follow the regular order. If you wish to make your motion later, after the papers on this morning's programme have been disposed of and the discussions on them have taken place, it will be in order; but the present programme must be proceeded with.

Dr. Peter H. Bryce, of Toronto, read a paper entitled "The Present Position of the Milk-Supply Problem from the Public Health Stand-point, and some Practical Methods for Securing Safe Public Supplies." (See page 144.)

Dr. Maurice Perkins.—I am interested in the point as regards the feed of the cow and keeping of the milk at milk-stations. If milk is not properly cared for it undergoes decomposition in a short time, and the rule should be that no milk shall be accepted from any farmer who does not properly look after the milk and prevent its decomposition.

Professor W. W. Daniells.—This matter of feed of the cow is an important one. I think the health authorities should take some means with regard to putting it before the public as it should be. Cows should be kept clean, and the feed should be wholesome, in order that the milk shall be wholesome when it gets to the consumers. I have given this subject considerable attention, and for years I have advocated to our state board of health municipal control; that is, no man should be licensed to sell milk within certain borders unless his premises are freely put under the examination of a municipal health officer, even though the place is entirely outside of the municipality which that officer represents. Still it should be the function of the officer to investigate the condition of that dairy, in all respects,—as to its wholesomeness, its surroundings, the water, and the condition of the cows.

Dr. Cantwell, of Iowa.—The subject of milk-supply is an interesting one to me. Last summer, in the month of July, a veterinary surgeon came to me and said a certain number of cattle were sick, and there were no restrictions against the farmers selling the milk from such cattle right along. We started an investigation, immediately sending a man to each dairy, and causing each dairyman to come in and register once a week the number of cows he had, whether healthy or not, the kind of food he fed them, etc. It seems the disease was of mild type. The cows began to grow less in milk, and in a few days they gave out entirely: they could neither eat nor drink. As soon as this investigation was made, the farmers quit trying to do anything for the cows, and they seemed to get well. This simply shows that we must be on the alert in making our investigations, and see that the milk is pure and well cared for.

In my town we have a glucose factory. Tons of this material are fed every day to these cattle with dry feed. We have, too, an experimental station or agricultural college there, and they have been experimenting with the glucose and other foods, and the relative increase in the milk of those cattle fed with glucose or sweet meal. The quality of milk was condemned, and our citizens opposed the idea of allowing us to feed our cattle with glucose at all. We cannot watch too closely the manner in which we get our milk.

Dr. Kinyoun.—In regard to Professor Bryce's interesting paper, I would like to emphasize his remarks relative to tuberculosis. I do not think there is enough attention at present paid by sanitarians to tuberculosis being transmitted through cow's milk. It is a difficult subject to discuss, as all veterinarians know, in connection with the animal. It may exist in the udder only slightly in the first stages. If the bacilli are set free from the surrounding tissues and are taken by the child, they in all

probability lay the foundation for the development of tuberculosis. In a great proportion of cases our means of diagnosis are difficult in the first stages of the disease. I would suggest that the system be put in operation the same as is practised in some parts of Paris and in Germany. It is the use of a specially constructed apparatus, which has the property of isolating nearly all bacteria, if not all.

Now, Klein has shown that diphtheria is a transmissible disease, not only from man to man, but cattle are subject to it, and that in the first stage of the disease, as soon as the ordinary local sore appears, the bacillus of diphtheria is present in milk, and can exist in a virulent form. The Pasteurization of milk is therefore a step in the right direction. Carefully carried out in laboratories, it is fraught with perfect results. But to put a complicated apparatus in dairies and expect dairymen to use it is asking too much. It is true, it removes many of the bacteria, but does not in a short time isolate or kill the bacillus of tuberculosis or the bacillus of diphtheria. We have to resort to other means. The boiling of milk will do it, although it is by sterilization of milk that our infant mortality is greatly diminished. The same changes take place by filtering milk through filters.

Dr. ———, of Kansas City.—Some few years ago, in this city, the duties of the city chemist were made those of the examination of milk with reference to its adulteration. I put myself on record as endorsing that movement, but deprecated the fact that the milk was not examined with reference to the finding of disease germs. There was no ordinance to make this examination of milk with reference to finding disease germs. Now, I confess that while I did not like to buy milk that was adulterated, I would rather believe I was paying for fifty per cent. pure milk than by buying diseased meat in the form of tuberculosis. This fact was so impressed upon my mind that I made an individual arrangement with dairymen (for my own family) to make an examination of 120 head of cattle before I was entirely satisfied to buy milk from any dairy. I examined 120 animals in order to be satisfied I was not getting tuberculous milk. The question of danger from milk is greater than that of tuberculous meat; but the fact is that the meat is always cooked, and there is a growing tendency to cook it well; while the percentage of pure milk is exceedingly small. This is a subject I am deeply interested in, and I hope it will be thoroughly discussed.

Dr. W. L. Schenck.—I would like to ask Dr. Bryce if he has made an investigation of the proper ventilation of stables for cows, and that if good ventilation would not tend to purify the milk.

Dr. Bryce.—I have not made such examinations, except I know, in a series of cattle kept by the same dairymen, some in ventilated and others in ill ventilated stables, that in the case of the latter, more indiges tion resulted. It is an undoubted fact that cows that have been regular in their milk-supply have finally turned out in a better condition for the butcher when their milk was reduced to three or four quarts daily.

Dr. Joseph Sharp.—It is absolutely necessary that farmers should sterilize their pans and every part of the apparatus containing milk. It seems to me the best solution of the question we have had so far is sterilization by steam. In my experience last year with a steam sterilizer of milk for infants, I came to the conclusion that persons of average intelligence can handle a steam sterilizer, and by its use can put their milk-supply in a better condition. It is certainly in advance of anything we have had heretofore, and I believe a person of ordinary intelligence can handle it well. It is simple, and the vessels into which the milk is to be put can be thoroughly sterilized. It is simpler than our means of filtration. Personally, I would not undertake to keep any system of filters in good condition.

Chancellor Snow, of the University of Kansas, read a paper (by invitation) on "The Propagation of Diseases among Chinch-Bugs." (See page 85.)

Dr. Homan, of St. Louis, Mo., offered the following resolution relative to vaccination, which was referred to the Executive Committee:

Resolved, That it is the sense of this Association that the production of supplies of vaccine virus, as regards quality and methods employed, should be subject to official supervision and regulation in the interest of public health.

Resolved, That to this end this Association favors legislation whereby the several state and provincial boards of health shall be empowered to exercise such supervision and regulation.

Dr. J. Ramon Icaza, of Mexico, read a paper entitled "A Few Considerations upon the Progress of Public Hygiene in the Republic of Mexico." (See page 221.)

Dr. Nazario Lomas, Cuernavaca (Moreles, Mexico), a member of the Board of Health of the State of Moreles, and director of the general hospital, contributed a paper on "Notes on the Hygiene of Rice Culture," which was read by Mr. Joaquin A. Vagas (interpreter), of Kansas City, Mo. (See page 34.)

Dr. Schenck.—All who have ridden on railroad cars recognize their defects in the matter of ventilation and heating. Railroad cars are no respecters of state lines. Railroad corporations, like other corporations, are run in the interest of the corporations; and it is one of those great questions that require national supervision for sanitary matters. I trust some resolution will be introduced here which may recommend such supervision in the interest of the people and those who are infected by disease in crossing state lines.

The report of the committee on "Car Sanitation," was then read by Professor W. W. Daniells, of Madison, Wisconsin. (See page 67.)

Prof. Delos Fall, of Albion, Michigan, in opening the discussion, said,—The people of the United States have been characterized largely as a nation upon wheels; and it is to that particular class of people who spend a great deal of their time on the cars that this subject is of vital

importance. It seems to me that there has been one point omitted in this report that ought to be brought before the Association, and that is the question whether or not it is reasonable or unreasonable to ask the railroad companies to disinfect the cars upon their roads frequently and thoroughly, more especially the sleeping-cars. I am sure there is not one of us who is studying along this line but knows and realizes the dangers that come from contact with the bed-clothing after it has been used by those subject to some infectious disease. We are, any of us, liable to infection from the night ride on the cars. It seems to me this question ought to be looked into and some suggestions made.

Dr. R. Harvey Reed.—The people of this country require rapid trains. There are five trains going out of Kansas City daily, all at the same time, and a large proportion of the travelling public will take the train which will get to St. Louis the quickest. They will take the train that is the most handsomely finished and with the finest tapestry. They demand this, and because they demand it the railroad companies furnish it to them, and do it gladly. If they do not do it, the road that does will get the passengers. The same thing pertains to the heating and ventilation of cars. When the public are aroused and enlightened as to the necessities of it and the present condition of such cars, then we may expect a reformation in that direction. If we undertake to secure laws to compel railroads to do certain things, we are liable to get wrong laws. The railroad corporations of this country are strong, and are liable to defeat us in such a movement. I should not recommend it. We shall not get good results until the public are educated as to what is required, then the railroads will gladly act accordingly. In this country statistics tell us that of the sixty million or more people, about fifteen millions are travelling all the time. This may seem a large number, and it was questioned at one time as to whether the statement was true. I secured my information from a member of the Chilian government, a civil engineer, sent to the United States to investigate the matter, and who at present resides in New York. He told me positively that about one fourth of the population of the United States travelled every day. This number includes passengers going to and from cities to their work, laboring men, business men, by steamships, ferries, boats, etc., but a large majority of them rode on railroad trains.

It seems to me an exceedingly important question, and one upon which the people should be enlightened. It is our duty, as members of the American Public Health Association, to impress people with the necessity of having more fresh air, better heating, and better ventilation on the railway cars than we have at present. When we secure these things we shall get others from the railroads. There is no question but that our heating and ventilating methods are absolutely defective. The people are awaking to the importance of this improvement. It is only recently that they have become interested. They are beginning to improve the ventilation of their houses. Passengers ride twenty or even five hundred miles on a great many of our trains on a stretch. A man gets off

with a cold: some one has had the window open near him, and there are few railroads that require their windows to be kept closed. These are the faults of ventilation. On the other hand, the cars are heated to excess: in a great many instances, there will be a difference in temperature of twenty or thirty degrees between the air at the floor and midway of the car. In one instance in our investigations we found the difference in temperature to be thirty degrees. We have our ventilators on top of the cars. It was clearly demonstrated last year, during which I made 232 analyses, that on an average there was but a fractional difference between the amount of carbonic acid at the level of the mouth and at the ceiling in a closed room. Even in rooms where there were open windows at the floor for the escape of foul air the carbonic acid distribution was almost equal. This, of course, revolutionizes to a certain extent our former theories in regard to carbonic acid. English scientists years ago taught that foul air was at the top. We made our examinations at the top and at the foot, and found them about equal. In making examinations of the three points, we found them equal, varying according to the draughts of air. The windows must be closed. We should keep the top ventilators closed and supply the passengers with fresh air at a healthy temperature. This must be done in a mechanical way, whatever plan may be adopted; and it must be simple, something that the railroads can utilize and keep in order at the least possible expense. Anything beyond that will be a failure so far as railroading is concerned. Whenever we secure something of this character, that will furnish to each man a sufficient quantity of fresh air, and take from the car the foul and retain the warm air, that is what we want. Whenever you open a top ventilator you allow the warm air to escape at once. If our railroads would adopt proper methods, it would be an economy to them, to say nothing about the comfort of their passengers. We must keep agitating this question, and the American Public Health Association should be the means of enlightening the people in regard to these necessities.

Prof. W. W. Daniells.—In regard to the disinfection of cars, I confess a change in my opinion as to what the report should be since I made some investigations. As I have said in the report, there are two sides to the question. The railroad has its side, and it is a stronger one than I had supposed. I have talked with intelligent railroad men, who have acknowledged faults in regard to their systems; at the same time we do not need the disinfection such as we have. Rather than ask the railroad authorities to disinfect such cars as the present Pullman cars, I would ask them to make the cars differently. Instead of covering them with elegant tapestry, they should use rattan furniture, from which there is no possibility of infection taking place. Doubtless this can be brought about. We want the people educated up to it: they must ask for things that shall be clean and kept clean, and not ask for those things which it is almost impossible to keep clean under the present conditions which now obtain, and which nobody can tell whether they are clean or not. I do not care how thoroughly

disinfected the present Pullman cars may be, after they become infected it is difficult to keep them clean. If we should have cars with simple furniture covered with rattan or velvet, easily kept clean, it would be better and nearer the thing we want, than to ask for expensive, upholstered cars.

In regard to steam: I was told that they cannot use steam to disinfect Pullman cars, because it destroys what they have taken great pains and expense to furnish—the upholstering and beautiful finish in the wood, etc. If our cars were simple in construction, steam might be used to advantage for the purpose of disinfecting. Again: The use of steam in heating Pullman cars rather destroys the life of a car, so that it can run only for three or four years, when it has to be overhauled. The simpler the interior portion of the car can be to furnish comfort—not luxury—the better it will be for all of us.

Dr. Joseph Sharp.—I rise only to give one or two instances in which I have good reason to believe that infection from infectious diseases had occurred on the cars. Two children from this city [Kansas City] were taken to Colorado to spend the summer, and, after being ten days in a camp twenty miles from any town, were infected. They had fever. Another case was a young man, sixteen years old, who had the commencement of scarlet-fever just about nine days from the time he made a trip from Chicago to this city. There was no scarlet-fever in the neighborhood in which he was living at the time. I know of an instance of a patient with small-pox riding from Dubuque to this city with an eruption covering two thirds of her face. This case occurred in 1881. Similar cases have occurred again and again. Every practising physician has seen numbers of instances where he had the very best reasons for believing that infection came from the cars. It does seem to me that the solution of this thing is in changing the character of the upholstery. I do not think we can get along with the rattan furniture. We have got to provide for the long continued jolting of those persons who are going to make long journeys. Air-cushions are useful things, which with temporary covers can be taken out, thoroughly washed and scrubbed, and disinfected either by heating or washing. They will prevent jostling or injury to the nervous system of weak persons who are travelling long distances. I do not see but that it is practicable, so far as the expense to the railroad company is concerned. We all agree that there is danger from infection in riding on the cars at night. I believe all practising physicians have the feeling that infection does occur again and again on board trains.

Dr. Clarke Gapen, of Omaha.—The root of the whole matter is the question of ventilation. Dr. Reed has touched upon that point, and all I desire to do is to emphasize it. People do not value fresh air as much as they should do. It is not valued enough in our public schools. A recent investigation of the schools in my city, and a similar investigation to some extent in the schools of other cities, show that the people do not know how much air they need. When they come to know that air is food,

and that it is necessary, not only for their existence and the well-being of their bodies, but for their comfort and happiness, they will demand all these things and get them; but as long as nine tenths of our homes and schools are insufficiently provided with fresh air, so long will the matter of ventilation of cars remain in its present condition. We should endeavor to impress upon the people the necessity of a sufficiency of fresh air. It seems to me when this step is urged the best disinfectant will be plenty of fresh air, with the suggestion that Prof. Daniells has made relative to a more simple upholstered car. With the use of water, and an abundance of fresh air passing through the car, the sanitation will become perfect. I think the suggestion of rattan furniture is an exceedingly good one. For some years I rode on the suburban cars of Chicago, and found them very comfortable. Some of the seats of the cars which run into our large cities are made with springs, and are at least as comfortable as upholstered cars.

PROF. DANIELLS.—I want to reply to one point brought out by Dr. Sharp, which does not affect the work the committee has to do at all. The cases he speaks of are exceptional ones. A similar case occurred in my own city. Last spring a young lady visiting the town in which I live was taken with diphtheria. A young physician, who was rather enthusiastic, found it out, and ordered a car by telephone, saying that he was going out to her home in about an hour. A special car was ordered to take the young lady to her home. He did this without the authority of the health officer; but the moment it was found out, the health officer was telegraphed where the woman was, the car was side-tracked, then thoroughly disinfected under the direction of the health officer, and the lady taken care of in that way. We punish men in Wisconsin for such things. No person should have a right to expose a community. However, that is not a subject of car ventilation, it rather pertains to contagious diseases. Our legislatures should attend to such cases directly. It does not apply to the matter under consideration. A car under such conditions should be as thoroughly disinfected as a building or house should be. These things should be taken care of by the local health authorities, and prevented so far as possible.

DR. HORLBECK, of Charleston, S. C.—Fresh air is the best disinfectant known. We have nearly accomplished the perfect ventilation of cars, through the efforts of Mr. Emerson, who has directed our attention to the matter. Last December he showed us what can be accomplished with his experimental car. He showed us that the atmosphere which was filled with tobacco smoke, etc., was cleared in five or six minutes; and still people are not satisfied with the experimental car known as the Evelyn. The people must be educated in the matter of ventilation of cars, and when they advocate it and pay for it they will get it.

DR. PLUNKET, of Nashville, Tenn.—I move that the report of the Committee on Car Sanitation be received and adopted, and that the committee be continued. Motion seconded and carried.

Dr. Hibberd offered the following resolution, which was referred to the Executive Committee:

WHEREAS, the mission of the American Public Health Association is the establishment and maintenance of public health by all rational and practicable means; and

WHEREAS, the Association has always held that an important agency in the success of their mission is, that the national government should have supervision of the general health of the people, and to that end has now, and for years has had, a committee at work to further this purpose; and

WHEREAS, the American Medical Association, at its session in June, 1891, inaugurated a renewal effort to bring the matter of public health in closer touch with the general government by the appointment of a committee to memorialize congress to create a Department of Public Health, the chief of which shall be known as the Secretary of Public Health, who shall be *ex officio* a member of the cabinet of Presidential advisers;—therefore,

Resolved, that the American Public Health Association hereby extends a friendly recognition of this additional effort of the American Medical Association to enlist the power of the national government in the general supervision of public health, and in the unifying, harmonizing, and energizing all state, municipal, and other methods of augmenting the sanitary welfare of the people of the United States.

FOURTH DAY.

FRIDAY, October 24, 1891.

MORNING SESSION—9 O'CLOCK.

The Association was called to order at 9 a. m. by the President.

The President called for announcements from the chairman of the Committee of Arrangements, but there were none.

SECRETARY WATSON.—I have some reports and announcements from the Executive Committee.

The Secretary then read both the resolutions of Drs. Homan and Hibberd offered at a previous session, the adoption of which was recommended by the Executive Committee.

Each resolution was then, on motion, approved by the Association.

DR. DANIEL C. JONES.—I wish to offer the following:

Resolved, That the Association return thanks to Col. G. W. Henry for the use of the auditorium; to Col. Nettleton for the railroad excursion to Kansas; to the Commercial Club for its entertainment; and to the Clearing House Association for its kindness.

On motion, the resolution was adopted.

Col. Morse offered the following resolution (which was referred to the Executive Committee):

Resolved, That the Secretary of the Association be requested to publish in leaflet, and send to the members, the report of the Committee on the Disposal of Garbage and such of the accompanying papers as may, in the judgment of the committee, be thought of value as a means of information.

THE PRESIDENT.—The election of new members will be the next thing in order.

SECRETARY WATSON.—The following have been recommended for membership in the Association (see list):

On motion, the Secretary was instructed to cast the vote of the Association for the gentlemen named,—which he did, and they were declared elected.

DR. DURGIN.—I move that a committee of one be appointed by the Chair to escort the newly-elected President to the platform.

Motion seconded and carried.

THE PRESIDENT.—I take pleasure in appointing Dr. Durgin to perform that duty.

Dr. Durgin then escorted President Formento to the platform, who was introduced to the Association by the retiring President, Dr. Montizambert, and spoke as follows:

Mr. President and Fellow-Members of the American Public Health Association: I hardly know how to express my sentiments of appreciation and gratitude for the high honor you have conferred upon me by electing me President of this learned Association, by calling me to the chair once filled by such men as Rauch, White, Baker, Hewitt, and others of no less scientific value, down to my immediate predecessor, Dr. Montizambert. Such men, gentlemen, cannot well be replaced. The honor you have conferred upon me is still the more to be valued as it was entirely unsolicited and unexpected, but I am candid to say that I could have no higher aspiration, no higher ambition, than the honor of being placed at the head of such an organization as an association of public benefactors, as has been properly said of men having no other object in view than the welfare and happiness of their fellow-men and the elevation of the sanitary condition of their common country.

Gentlemen of the Association, I consider it a high compliment to be selected by you as your standard-bearer in this common cause, this struggle of science against disease and death, of reason and enlightenment against prejudice and ignorance. I consider it a high compliment to my native state, which will have been twice honored by you, once in the person of my illustrious predecessor, Dr. White, and now in the person of your humble servant. Such an honor, such a compliment, will, I know, be highly appreciated by the people of Louisiana, who will look upon it as a new testimonial of the perfect accord and unity which exist in every part of our united and beloved country. [Applause.]

Gentlemen, let me congratulate you upon the choice you have made of the City of Mexico for our next meeting. No wiser or more appropriate selection could have been made. It would have been difficult to refuse the repeated and urgent invitations of our Mexican friends, and the promises of generous hospitality and cordial reception which a simple invitation from such men implies. It means a welcome, a reception such as this Association has never received, not even in our hospitable city of New

Orleans. The proverbial Castilian gallantry and generosity, transplanted in Mexico, in this rich and beautiful garden of America, has attained magnificent proportions. Besides—and this is the most important—by selecting Mexico for our next meeting, we establish new bonds of friendship and confidence with the citizens of our sister republic; we bring about a concert of action and a thorough understanding between the sanitary authorities of that country and our own. We form with the United States, Canada, and Mexico a triple alliance, not for war and destruction, but for peace and happiness. [Applause.] By coming into closer relations, we shall learn to know and better appreciate each other. By coöperation we may come to adopt such measures as will secure our seaports against the introduction of foreign pestilence; we may succeed in eradicating certain foci of disease, and the yellow-fever which is a constant menace to our people. We, of Louisiana, situated as we are on the frontier, have a more direct interest in this great question of sanitation, and the prevention of importation of disease which does not belong to our soil and climate.

We are the advanced post of an army of sanitarians. The Association now comprises delegates from Canada, the United States, and Mexico. Let us hope, that by carrying our public meeting and deliberations beyond our frontier into Spanish Mexico, we shall succeed in bringing together under our common banner the health authorities and sanitarians of Cuba and of Central and South America. By going to Mexico, we are about to take the first step toward accomplishing this result. Then we shall become really strong and potent for good. In sanitary science, especially in establishing international sanitary relations, as well as in politics, "union is strength." But I wish to put a stop to my remarks, and in so doing I can only reiterate my thanks for the honor conferred upon my state and myself, and to assure you that I shall do everything in my power to prove myself not entirely unworthy of the high position I have been called upon to fill. [Applause.]

The appointment of a new Advisory Council was then proceeded with.

Secretary Watson.—I would respectfully move that the name of Dr. Covernton, representing the Dominion of Canada, be dropped, and the name of our retiring President, Dr. Montizambert, substituted. Dr. Covernton has not been able to attend the meetings of this Association for several years. It is with no disrespect to Dr. Covernton that I do this, but it seems eminently proper that Dr. Montizambert should be put on the Advisory Council.

Dr. Montizambert.—I should be glad to have my associate remain, but of course I shall be governed by the action of the Association.

On motion, Dr. Montizambert was appointed to fill the place of Dr. Covernton.

The report of the Committee on Protective Inoculations in Infectious Diseases was called for.

Secretary Watson.—I received a letter from Dr. Sternberg, to the

effect that in another year the committee would be able to present a valuable report; that considerable experimental work has been and is being carried on by a gentleman in Germany who is working for the committee. So it is announced by Dr. Sternberg that the report will be a large one, and one which, in his opinion, will reflect credit upon the Association.

The President called for the report of the Committee on National Health Legislation, when Dr. Plunket, a member of the committee, arose and read a letter from the chairman, Dr. Walcott, stating that the committee was unable to have a meeting. No report.

When the report of the Committee on the Cause and Prevention of Diphtheria was called, Secretary Watson stated that he had received a letter from Dr. Ashmun, chairman of the committee, saying that the committee was still at work, but had no report to make at this time.

The Secretary then stated that no reports had been received from the following committees: On the Causes and Prevention of Infant Mortality, and on Restriction and Prevention of Tuberculosis.

The President then appointed committees for the ensuing year. (See list of committees.)

Dr. Hibberd offered the following resolution of thanks, which, on motion, was adopted unanimously:

Resolved, That the members of the American Public Health Association attending this meeting fully recognize that the profits of the occasion, each of which have been great, have been due mainly to the complete conception of what was needed to ensure success, and to the untiring executive ability with which the formulated plans have been carried out. For this we are indebted to Dr. E. R. Lewis, chairman of the Local Committee of Arrangements, and his associates; and we hereby offer him and them our congratulations, and tender our heartfelt thanks for our instruction at the stock-yards, for the enjoyment of a dashing railroad ride into Kansas, for the reception by the Commercial Club, and for many social pleasures from the residents of Kansas City.

Dr. Charles N. Hewitt, of the Minnesota State Board of Health, made some remarks on "The Existing Methods of Dealing with Emigrants," as respects infectious diseases in England and on English ships, and the notification of infectious diseases among immigrants to the United States, the duty of the national sanitary authorities to the sanitary service of the United States; an example of such an arrangement between the United States authorities and the State Board of Health of Minnesota.

He said,—It happened, in going abroad this summer, that I did not have the pleasure of the company of the President of this Association [Dr. Montizambert], as I expected to have had, going to attend the Seventh International Congress of Hygiene and Demography. He was detained with official business at the last moment. Just before I left, the Provincial Board of Quebec and the health officer of Montreal called my attention to the Allan line, and requested me to make inquiries for them in England. It is a curious fact that we have been discussing immigration and emigration for so many years, and we have not yet got at the real essence of

the whole matter. Let me read you the exact facts as they were called out by the Allan S. S. *Brazilian*. Dr. Hewett then read the following:

April 13th, 1891, the Allan S. S. *Brazilian* left Montevideo with a cargo for London. On the 22d A. R———, able-bodied seaman, came down with small-pox, and was isolated on deck in a boat, and the captain cared for him.

May 8th the ship arrived at Gravesend, late at night, and at 9 o'clock next morning the deputy medical officer of the port came on board, ordered the removal of the sick man and his effects to the hospital, the destruction of bedding by fire, the disinfection of infected places on the ship with burning sulphur, and offered free vaccination to the crew. The last was rejected, and the ship was given permission to leave at 10:10 a. m. She sailed for France, took on wool at Dunkirk, and returned to London on the 13th. She discharged a part of her crew, replaced them by new men, and sailed on the 16th for Montreal.

On the 19th the captain had the small-pox. On the 20th the fourth engineer had it, and was put in the cabin with the captain. On the 27th an apprentice, R. I. P———, feeling unwell, was isolated in the cabin, where he had been in attendance on the captain.

On the 29th the ship reported at the St. Lawrence quarantine, where she anchored. Within the next twenty-four hours the sick had gone to the hospital, the crew had been vaccinated with fresh animal virus, the ship had been drenched with bi-chloride of mercury spray, and infected places treated to superheated steam. On June 5th, after about seven days' detention, the ship was released. The apprentice P——— had rapidly recovered from his ailment, which was not small-pox, and was re-vaccinated with the crew, but it did not affect him, though working on most of the rest. He was so well when the ship went out for London, on June 11th, that the doctor permitted him to join. On the 19th he was taken sick, and died of small-pox on the 22d, two days from London. The new captain reported the fact, the only unvaccinated sailor accepted vaccination, and the infected berth and things were treated to sulphur fumes. The ship reported "no new case and all well" when she passed Grosse Isle, July 5th, going to Montreal.

When presented to the English authorities at Whitehall, the question was asked what it meant. Well, they said, it means what it says. We do not isolate families and ships, because a ship is treated as a house. It is not isolated for the infection which may be there. The infection is removed and the ship allowed to go.

The important point for us in this little history is, the fact that when a case of small-pox arrives on a ship at an English port, the sick is removed with his effects to the hospital, his bedding is usually burned, the place he occupied is disinfected with the fumes of sulphur burned in an iron pot by a sanitary inspector, the crew are offered vaccination, the acceptance of which is voluntary, and the ship is then permitted to go. In this case the time occupied was less than two hours, and then the vessel was allowed to go to another country, France. The dates are so well fixed, by the log of the steamer, and confirmed in other ways, that they enable a very probable statement of the origin and distribution of the infection.

The first case took the infection of small-pox about a week before he left South America. Though exposed to the first case from the 13th of April, the two others (captain and fourth officer) did not take the infection till the 5th to 7th of May, a few days before reaching Gravesend. The last case had at least three distinct and separate exposures; the first from the original case, the second from the captain and engineer whom he

attended on the ship, the third from them while in the hospital at Grosse Isle. The last exposure gave the infection and was fatal, though vaccination with fresh animal virus, by thoroughly competent hands, failed.

The dates show further: That had the Allan Company done what they have been repeatedly urged to do,—make re-vaccination a prerequisite in selecting officers and crew,—no case would have occurred on the *Brazilian*, the week of anchorage at St. Lawrence quarantine would have been saved, as would the life of the unfortunate apprentice. It is very evident, too, that the danger of the exportation of small-pox to Scotland (where the discharged men are reported to have gone), France, Canada, and the United States, would have been prevented.

Protesting against the manifest carelessness of such management, the speaker was informed that cholera, yellow-fever, and plague were the only diseases against which the isolation of infected vessels and their inmates is used in English ports. No arrangement has, as yet, been made to examine trans-immigrants (*i. e.*, persons crossing England on the way to America or elsewhere), though the need therefor is very apparent from English experience. In fact, there is the same danger of the introduction of the disease we are discussing, from America into England, but not to the same extent, because the current is very largely the other way. I was frequently reminded that vaccination was compulsory there early in life, and gave them a greater freedom from the danger referred to than we, in the absence of compulsory vaccination, can have. It will be easy to show, from English experience, that small-pox is still as dangerous there as with us, and that it would be a common-sense precaution to submit persons and things, exposed to its infection on ship-board, to the restraint of isolation and disinfection; and, in addition, to insist on a re-vaccination or the evidence of a previous successful vaccination.

I saw the medical officer who made this inspection. He let the ship go. Vaccination was freely offered, and they would not take it. So you see what the result was. I went to Liverpool to see how the inspection was done there. I found this to be a fact, that there are four authorities in charge of quarantine at the English port. I had occasion to notice the method of inspection. In going through the ship, I saw a gentleman who was represented to me as being the medical officer of the board. I went up to him and said (I told him who I was),—"Will you allow me to accompany you on your inspection?" He was very glad to have me accompany him. It was raining when we went aboard the ship; the emigrants were crowded in one corner, and we stood under a shelter. One emigrant after another passed hurriedly by, the inspector looking out for any swelling or noticeable eruption. The method was imperfect. This is what occurs in Liverpool. Dr. Taylor has made inspections afterwards, and has found cases of small-pox. A case or cases of small-pox are landed at Liverpool, the medical officer not reporting them. An emigrant thus afflicted will start small-pox in the country. Such a thing has happened, and can happen, in Liverpool without the possibility of the authorities knowing it.

And while we are criticising English methods, let us take our own country. England does not notify us of emigrants exposed to small-pox that comes across on the ships. They come into the New York harbor, and Dr. Smith inspects them, and if he thinks or knows that there is anything the matter with them, he isolates them. He does not send any notice in the country, and we have no means of knowing whether or not persons have been exposed to small-pox, diphtheria, or any other diseases that have gone through quarantine. We complain of England, but we are doing at home just the same thing.

Last April I appealed to let Minnesota have a chance, and by good luck and the support of my friends, and the Marine Hospital service of the United States, we have an arrangement by which we are now notified of the arrival of an emigrant exposed to infection; the name of the disease being given, date of exposure, name of the ship, etc. For the first time, in the history of sanitation in the United States we have secured for one state at least the notification of infectious diseases from without our borders. That this is an important step I think you will concede. It is not through the New York quarantine that all cases of infectious disease come to Minnesota. They come from farther West, through the great centres, and a large proportion of them come through the quarantine service of the Canadian government. The Canadian government has eight or nine inspectors connected with its quarantine service—and let me say here, one of the most efficient of these services is presided over by Dr. Montizambert. During the summer-time, if vessels are discovered coming in they are ordered to stop, and they are either inspected by the medical officer or by a subordinate officer. The inspection is competent, so far as it goes; but in the winter-time immigration comes in through Halifax, and we have no means of dealing with them at all. The only knowledge we have of what is going on is through the courtesy of an officer. He does not cover enough ground; he simply notifies the provinces of Ontario, Quebec, and Manitoba that small-pox has arisen at such a place. Every means that he could take has been taken to protect immigrants from infection. The infected cases are removed from the ship, and the ship goes through a most efficient overhauling; but would it not be better to give the name of the ship, date, destination, and number of cases having been exposed, etc.? The only possible way we have at present of coöperation between the sanitary administration in England and the United States is through the influence of a sanitary movement.

The point I desire to make is, that we must move upon our own government. We have prevented small-pox by catching the infected parties when they arrived. We want to have a better understanding as to what is to be quarantined on the sea-board. A case of infectious disease may leave a certain port, land in Minnesota two days before the period of incubation, and start a pest. The only way to do this, I admit, is not alone by this Association, but by having active men, men of influence, who will take the initiative, and proceed deliberately to see if they cannot organize and

reconstruct the emigrant service of the United States government in such a way that it can best serve this purpose.

One more point, and that is, any one who has studied the matter of state and international quarantine as long as I have, and has dealt with it practically, has learned one thing, that he is not running a machine, or that a resolution by this body will do this and that. The people want to know what ought to be done, and we must put the matter clearly before them. What we want in all our states is a prompt and efficient notification of every case that is exposed to infectious diseases. I think you will agree that the move we have taken in the case of our state [Minnesota] is one in the right direction.

Dr. Joseph Sharp.—I only want to place on record an instance of small-pox introduced into this city [Kansas City] by passing quarantine regulations. In 1881 we had an epidemic of small-pox in this city, and I was employed with the city physician to render medical aid. We had some fifty-four cases on our hands. The population at that time was something like 50,000. I attended a patient, a little girl six years old, with small-pox, although I was a little in doubt about it. The case mystified me a little. Two or three weeks after my patient had been sick, one day the city physician met me and said, "Doctor, I wish you would come along with me to see a case of small-pox." We went two or three blocks from where my patient was located, and found that a baby had died of the disease. The family were German emigrants, only in the city a few weeks. We found another centre originating there for the spread of the disease. The German emigrants passed quarantine, and within ten days had landed at Kansas City, and the cases of small-pox had been concealed by the connivance of a German physician who was attending them. (By the way, we fined him $200.) The New York papers were announcing small-pox as coming in on the emigrant ships. This one case infected some six or eight new cases. There was one death.

Dr. Clark, of Buffalo, N. Y.—I have seen the results of the inefficient methods which prevail at this port [New York]. In the year 1888, month of June, we had a case of small-pox brought to our city. In Buffalo we have forty thousand Polish people that have been coming there since 1883, and a large proportion of them have never been vaccinated. These people were taken in Buffalo, through an inefficient local board. I tried to trace the cause of the outbreak, and I found that a Polish emigrant had left a town where small-pox was prevailing, and had embarked on one of the steamers at Bremen. He reached New York and Buffalo without being suspected of having an infectious disease. The papules were not distinct. It was evident that the process of desquamation had been completed but a short time before. He brought with him a trunk containing his clothing, went to a Polish house in Buffalo, and of the forty persons living there more than one half were under fifteen years of age—children; and in two weeks from the time he went into the house there were eight cases of small-pox, and it gradually spread among the people until we had

147 cases before we got the disease stamped out. These Polish people are mostly laborers for street-car companies, etc. It became necessary to organize a health department for vaccination. We vaccinated 75,000 people. From the 147 cases there were forty-two deaths. It cost the city of Buffalo $20,000 to do it. The expense became necessary through the inefficient methods at the inspection station in New York. I was told by the emigrant that his trunk was not examined or disinfected in New York. Cases spread all over the country from this one case. A few cases even reached Chicago. A few cases of small-pox were traced along the Hudson river. If I had time I could relate a great many interesting cases and points drawn out from this epidemic, because I had a good chance to study the question of vaccination.

Dr. A. N. Bell.—The matter of inefficient inspection at New York seems to have been well stated by the members, but they doubtless do not understand that there has been a recent change, that an improvement has been made with regard to the registration of emigrants to the port of New York. While I think the officer should inspect all emigrants with reference to protection from small-pox, I do not feel that he has the power to compel all such persons to inform him of their destination. He may require that they be vaccinated or have evidence of vaccination en route, but the registration ought to be compulsory in the office of the commissioners of immigration. Recently they register all arrivals, with their ages, nationality, destination, and everything connected with it. That is transferred to the general government. A new depot has been opened on the Island for the special purpose of inspecting every emigrant.

Dr. Domingo Orvañanos, of Mexico, then made a few complimentary remarks, which were interpreted by Mr. Vagas, as follows:

Gentlemen: Dr. Orvañanos wishes to express his gratitude for the welcome that has been given to the delegation of Mexico in Kansas City by this Association. He wishes also to state that he feels more than glad that the next meeting will take place in the City of Mexico. He believes you will profit a great deal by observation there and social intercourse; that you will doubtless find some things to censure and some things to commend. He assures you that when you come to Mexico you will receive a hospitality equal to that which you have received in Kansas City. [Applause.]

Dr. R. Costa followed with a few appropriate remarks in a similar manner, and predicted a grand success both socially and scientifically for the next meeting.

Dr. A. N. Bell, of Brooklyn, read a paper entitled "The Bath and its Adoption." (See page 180.)

A Member.—What is the average charge for such baths?

Dr. Bell.—Ten cents; that is, at the dispensary. At the Society for Improvement of the Poor, it is five cents. If they have not five or ten cents, it is given to them free.

The following papers were then read:

"Considerations upon the Endemical Character of Yellow-Fever upon the Coast of the Gulf of Mexico," by Dr. Gregorio Mendizabal, Vera Cruz, Mexico. (See page 193.) "Some Hints on Diphtheria in the Mexican Highlands," by Dr. Jesus Chico, of Guanajuato, Mexico. (See page 205.)

On motion of Secretary Watson, other papers, whose authors were not present, were read by title and referred for publication.

Secretary Watson offered the following amendment to the constitution, section 10:

To amend section ten of the constitution of the American Public Health Association by inserting after the word "Province" the following words: "The Republic of Mexico and each of the Mexican States."

THE PRESIDENT.—This completes the work of the nineteenth annual meeting. I wish to thank you, gentlemen, most sincerely for your kindly support and the consideration which you have uniformly extended to me, and which has rendered easy and pleasant the discharge of my duties as president. [Applause.]

On motion of Dr. Hibberd, the Association then adjourned to meet in the City of Mexico, 1892, at such time as the President and the Local Committee of Arrangements may appoint.

REPORTS OF COMMITTEES.

PRESENTED AT THE NINETEENTH ANNUAL MEETING OF THE AMERICAN PUBLIC HEALTH ASSOCIATION, KANSAS CITY, MO., OCTOBER 20–23, 1891.

REPORT OF THE COMMITTEE ON NECROLOGY.

[1] Hosmer Allen Johnson, A. M., M. D., LL. D., was born in the town of Wales, near Buffalo, N. Y., Oct. 6, 1822, and died at his residence Feb. 26, 1891, surrounded by his family and friends. His father was Samuel Johnson, a farmer, and his mother was Sally (*née* Allen) Johnson. Hosmer Johnson was the first-born, and during his infancy the parents changed their residence to the neighboring town of Boston, Erie county, N. Y.

Here they remained ten or twelve years, during which the son received the first rudiments of education in the district common school of the neighborhood. In the twelfth year of his age, the family moved to the town of Almont, Lapeer Co., Michigan. During the next six years he was engaged in helping to bring under cultivation the new farm, with no opportunities for attending school. But with a natural thirst for knowledge and an active intellect, aided by his mother, he improved all the hours not actually occupied in manual labor, in mastering the elementary branches of knowledge. At the age of sixteen he received a severe mechanical injury which probably laid the foundation for the pulmonary troubles that so often afflicted him during his subsequent life. In his eighteenth year he spent the winter in teaching school in a log school-house in a neighborhood of lumbermen, and three years later, having attained the age of 21 years, he commenced earnestly the work of acquiring a liberal education. For this purpose he entered the academy at Romeo, Michigan, in the spring of 1844, and continued until the autumn of 1846, doing farm-work or teaching during the vacations to obtain money to defray his expenses. In the autumn of 1846 he was admitted to the sophomore class in the University of Michigan, at Ann Arbor, where he pursued his studies and met his expenses in the same way as at the academy. In the summer of 1848 he suffered from pulmonary hemorrhage and impaired health to such

[1] This biographical sketch of the life of the late Professor H. A. Johnson was presented by Professor N. S. Davis at a meeting of the Council of the Northwestern University.

an extent that he went south as far as St. Louis and Vandalia, Illinois, and remained in the latter place through the succeeding winter. He improved his time in teaching school and prosecuting his collegiate studies; and becoming acquainted with Dr. J. B. Herrick, then practising in Vandalia, he first began medical studies in his office.

In the spring of 1849, with improved health, he returned to the Michigan University, passed all the required examinations satisfactorily, and received the degree of Bachelor of Arts. The next year he was occupied in teaching at Flint, Michigan, and in reading medical works. In the autumn of 1850 he entered Rush Medical College, at Chicago, and at the end of his second annual course of medical college instruction, February, 1852, he received the degree of Doctor of Medicine, ranking as first in his class. During the same year he also received from the Michigan University the degree of Master of Arts. While in the medical college he read in the office of Wm. B. Herrick, Professor of Anatomy, an older brother of Dr. J. B. Herrick, of Vandalia, with whom he had first commenced professional study. Soon after graduating in medicine he became associated with the professor of anatomy, both in practice and in editing the *Northwestern Medical and Surgical Journal*, and rapidly acquired reputation and business. During the following winter, however, he found it desirable to spend some time in the South, but returned with improved health in the spring of 1853 and resumed his previous business relations, and in addition was appointed Lecturer on Physiology in the Rush Medical College. The unusual ability he showed as a teacher and lecturer caused his appointment, in 1855, to the Professorship of Materia Medica, Therapeutics, and Medical Jurisprudence in the college, and at the end of two years to be transferred to the chair of Physiology and General Pathology. The duties of the latter chair he performed with signal ability and to the satisfaction of all parties, but at the end of the college term of 1858–'59, he resigned his chair and severed his connection with the college, on account of what he deemed a very unfair financial transaction by the president of the college. From 1855 to 1859 he was an active member of the Medical and Surgical Staff of the Mercy Hospital, and an interesting clinical instructor.

Almost immediately after Dr. Johnson had severed his connection with the Rush Medical College, the trustees of the Lind University, of Chicago, offered an opportunity to organize a medical department of that institution, for which a charter had recently been obtained from the Illinois state legislature. The opportunity was embraced by Dr. Johnson, in conjunction with Drs. Edmund Andrews, Ralph N. Isham, and David Rutter, and the new college commenced its first annual course of medical instruction in the autumn of 1859, Dr. Johnson being president of the faculty and Professor of Materia Medica and Therapeutics. On account of continued financial embarrassments on the part of Lind University, in 1864 the medical department organized as an independent medical college, under the name of Chicago Medical College, which it still retains, although it

has constituted the medical department of the Northwestern University since 1869.

Dr. Johnson continued to fill the office of president of the faculty until 1866, and in the mean time filled successfully the chairs of Histology and General Pathology, of General Pathology and Public Hygiene, and Clinical Medicine, in the Mercy Hospital.

In the spring of 1865 he was compelled, by failing health, to cross the Atlantic and spend a few months in Europe, but returned in the autumn in time to resume his college and other professional duties. Early in 1866 renewed pulmonary troubles compelled him again to seek relief by a change of climate, and he resigned both the presidency and the professorship of Pathology and Public Hygiene; but continued his connection with the college by accepting the office of president of the board of trustees, and the honorary title of Emeritus Professor of General Pathology and Public Hygiene. Before the end of the following year, however, he yielded to the solicitations of the faculty of the college and accepted a professorship in Pracical Medicine, with the duty of lecturing only on diseases of the chest. He continued to hold this position and to perform the duties assigned until 1881, when he again retired from active teaching and accepted the honorary position of Emeritus Professor of the Principles and Practice of Medicine, which he continued to hold, together with that of president of the board of trustees of the college, until his death. Throughout his whole professional career he was an active supporter of medical and scientific associations. In 1852 he became a member of the Chicago Medical Society, and of the Illinois State Medical Society. He held the office of secretary of the latter six years, and was elected its president in 1858. In 1854 he became a member of the American Medical Association, and was one of its secretaries in 1860. In 1865 he was a delegate from the Association to the Medical and Scientific Societies in Europe. He was an active and honored member of the American Public Health Association, and was its president in 1889. In 1853 he became a member of the American Association for the Advancement of Science, and has been one of the founders and active supporters of the Chicago Academy of Sciences, and of the Chicago Astronomical Society, in both of which he has held the highest offices.

In 1888 he was elected a member of the board of trustees of the Northwestern University, and on the 14th of February, 1891, he was elected, by the faculty of the Medical College, a member of the University Council.

For several years he was a member of the Consulting Medical Staff of the Cook County Hospital, the Chicago Eye and Ear Infirmary, and of the St. Luke's and Michael Reese Hospitals. In 1853 he was initiated into the Masonic Order and was rapidly advanced to the grade of Master Mason. In 1855 he was Grand Orator of the Grand Lodge of Illinois. The next year he organized the Grand Commandery of Knights Templar of Illinois, and for two years was its first officer. In 1861 he was enrolled

as an active member of the Supreme Council at Boston, and remained a Mason of the highest rank until his death.

In June, 1861, he was appointed, by Governor Richard Yates, a member of the board of medical examiners for the state of Illinois, to examine candidates for appointment as surgeons and assistant-surgeons in the volunteer army, and he served as president of the board until the close of the war. During the same period he was the chief medical adviser of the governor, and adjutant-general of the state, and several times visited the troops in the field and the hospitals connected with the service. In 1863, at the request of the United States sanitary commission, he visited the military department of the South. He also served several years as a member of the Illinois state board of health, as a member of the national health board, and as a most useful member of the Chicago relief organization after the great Chicago fire of 1871.

Yet, throughout his entire career, he was actively engaged in the work of an active and skilful general practitioner of medicine, always with as large and faithful a clientage as his time and health would permit him to serve. In 1855 Dr. Johnson married Margaret Ann Sevard, a most estimable woman, and in due time they were blessed with a son and daughter. The latter died in 1888, but the son and mother survive.

Dr. Alfred F. Holt was born in Lyndeborough, N. H., December 16, 1838. He lived on a farm in that town until 1857, attending the public schools, and an academy at Mt. Vernon. In the summer of that year he began studying medicine, attending lectures at the Harvard Medical School during the winters of '58–'59 and '59–'60. In the spring of 1860 he attended another course of medical lectures at the University of Vermont, where he was graduated as a doctor of medicine. In the fall of 1860 he began practising medicine in Cambridge. On April 17, 1861, he joined the first company of volunteers organized for the war, serving a few days as a private, and then being promoted to the position of hospital steward, in which capacity he served three months. His company was attached to the Third Regiment, M. V. M., and designated as Company C. This regiment assisted in the destruction of Gosport navy-yard near Norfolk, and served at Fortress Monroe and Hampton. In November, 1861, Dr. Holt joined the medical department at Camp Chase, Lowell, working in the hospital till December 6, when he was appointed assistant-surgeon of the Eastern Bay State regiment, afterwards known as the Thirtieth Massachusetts Volunteers, going with the regiment to the Department of the Gulf and serving with it till December, 1862, when he was promoted to surgeon of the First Texas Cavalry. He served there till December, 1863, when he left the medical department and received a commission as senior major in the same regiment. In the fall of 1864 he was made lieutenant-colonel, in which capacity he served till October, 1865, when the regiment was mustered out of service. During this service he participated in nearly all the battles and campaigns of the Department of the Gulf. He returned

to Cambridge in 1866, and again began practising. In July, 1879, he was appointed medical examiner, and in January, 1884, he was commissioned surgeon-general, in both of which capacities he was serving at the time of his death. The deceased had also been a health officer of Cambridge, and was a member of the American Public Health Association, the American Medical Association, Massachusetts Medical Society, Cambridge Society for Medical Improvement, American Association for the advancement of Science, Loyal Legion, and Grand Army of the Republic.

Dr. Holt had been a widower for twenty years. He leaves no children, but has a brother and four sisters living. Dr. Holt stood high in his profession, and was celebrated as a microscopist, having for many years been an authority in the study of morbid anatomy. He died at Martin, Fla., of Bright's disease, with a heart complication.

Supervisor-at-Large Paul H. Kretzschmar was born in Dresden, Germany, June 7, 1847. There he began the study of medicine, and graduated in pharmacy before reaching the age of twenty-one years. After attaining his majority he married, and his young wife and himself determined to seek their fortune in America. In 1869 they arrived in New York city, where he obtained employment as a drug clerk. In 1872 he went to Brooklyn, and two years later opened a drug store on the corner of Fulton and Adelphi streets. Then it was he entered the Long Island College Hospital as a medical student, and three years later graduated as a doctor at the head of his class. He had a good practice from the beginning of his career as a doctor.

His wife died in 1880, and in 1885 he married Mrs. Moran, widow of Francis Moran, of Brooklyn, N. Y.

Although he gave strict attention to his duties as supervisor-at-large, and possessed an extensive practice as a physician, he was engaged in a multiplicity of other pursuits. He was president of the Long Island College Alumni Society, treasurer of the Electric Automatic Battery Company, a member of the Medical Society of King's County, of the Oxford Club, the Germania Club, the Constitution Club, the Reform Club, the German Press Club, the Physicians' Mutual Aid Society, of Independent Royal Arch Lodge, No. 2, F. and A. M., Clinton Commandery, Constellation Chapter, and of Mecca Temple, New York Consistory, A. and A. Scottish Rite, thirty-two degrees. He was also a member of the New York Academy of Medicine, the Pathological Society, the State Medical Society, the Climatological Society, a trustee in the Peoples' Trust Company, director of the Bedford Bank, and treasurer of the City Savings-Bank. He was elected to membership in the American Public Health Association in 1889. His death occurred at Brooklyn, N. Y., April 27, 1891. He leaves no children.

Dr. John J. Milhau, late surgeon and brevet brigadier-general, U. S. A., died in New York on May 8, 1891. He was born December 28, 1828. He graduated from the College of Physicians and Surgeons, New York, in

1850, and the following year was appointed assistant-surgeon in the United States army. During the next few years he served on a number of important expeditions in the West, and when the Civil War broke out, in 1861, he was appointed medical inspector of the Army of the Potomac. He afterwads became medical director of the Third Army Corps, and was present at the siege and capture of Yorktown, the battles of Williamsburg and Seven Pines, the Seven Days Fight, and the Second Battle of Bull Run. In 1862 he was medical director of the hospitals at Frederick, Md., and in 1863 and 1864 was medical director of the Fifth Army Corps,—being on duty at Gettysburg, Spottsylvania, Petersburg, and many other important battles. In the latter part of 1864 he was compelled, by ill health, to withdraw from active work in the field, and was ordered to New York. Between 1867 and 1869 he served as medical director of the Third Military District, Department of the South. December 2, 1864, he was brevetted lieutenant-colonel for gallant and meritorious services before Richmond. March 13, 1865, he was brevetted colonel for gallant services during the war. September 28, 1869, he was brevetted brigadier-general for merit and distinguished services at Hart's Island, N. Y., during the cholera epidemic, where he alone remained to attend to the sick. In 1876 he resigned from the service, and since then has continued to reside in New York, where he was greatly esteemed by all who came in contact with him. General Milhau has, during the past few years, held many positions of honor and trust, and for eight years was one of the commissioners of the state board of charities. He became a member of the American Public Health Association in 1873.

Dr. Carl Herman Horsch died in Dover, N. H., September 22, 1891, aged 69 years.

Dr. Horsch was born July 23, 1822, in the village of Eythra, near Leipzig, Saxony. His parents were poor, and his early life was one of toil and hardship. Fortunately the village school-master saw the boy's worth, and awakened in him a thirst for knowledge. Working his way in the world, and studying when opportunity offered, he, when twenty years old, walked from Leipzig to Prague, to enter the University. Here he studied six years, supporting himself by his own exertions. He graduated from the Medical Department, September, 1848, receiving especial commendation from his professors.

Returning home, Dr Horsch, October 1, 1848, entered the Saxon army as assistant surgeon in the Field Hospital. March, 1849, he was transferred to the Ambulance Corps, and served therein during the Schleswig-Holstein war. June 5, 1851, he was commissioned company surgeon in the King of Saxony's body-guard. He held this position nearly three years, when he resigned, at the solicitation of American friends, to emigrate to the United States. He resided a year in Boston, Mass., but preferring the country, he settled in Dover, N. H., August, 1855, where he remained during his life in a large and successful practice.

In the winter of 1862, Dr. Horsch was appointed surgeon of the Fifteenth Regiment New Hampshire Volunteers. At the siege of Port Hudson he was appointed an assistant operator, and in a few days was promoted to the rank of a first operator. Overwork and exposure at that siege brought on malarial fever, which nearly proved fatal, and from the effects of which he never fully recovered.

In 1882, at the recommendation of many of the prominent physicians of New Hampshire, Dr. Horsch was appointed a member of the state board of health. He helped organize it, and served thereon until failing health compelled him to resign, in 1886. For the last six years of his life he suffered from an organic disease of the heart (insufficiency of the mitral valve), which obliged him to give up his active practice in 1888. He was a member of the American Public Health Association, the American Medical Association, the Medico-Legal Society, New York, and the Strafford District Medical Society, New Hampshire, and president of the last in 1887–'88. A widow and two daughters survive him.

Dr. Horsch had a lofty, noble character. He was strictly conscientious, and always openly and fearlessly acted according to his convictions, whether others approved or he stood alone. He cared nothing for rank or precedence, his only desire being to benefit his fellow-men. For many years he devoted much time and labor to sanitary subjects, and was ever among the foremost to engage in every cause to benefit humanity. He always wished to impart his knowledge to others: and at all times assisted younger physicians. Everybody who came in contact with him was strongly attracted toward him. The mourning for him was universal throughout his adopted city.

Dr. Richard Gundry was born in England, near London, about 1829, the son of a talented clergyman. In 1845 he went to Canada, and soon afterwards began his medical studies. He graduated five years later from the medical department of Harvard University. He began medical practice at Rochester, N. Y., but in 1854 removed to Columbus, O., to become an assistant physician in the lunatic asylum. In 1857 he went to Dayton to occupy a similar position, and became superintendent of that institution in 1862. He was afterwards identified with the care of the insane at Athens, O., and again at Columbus, and later at Catonsville, Md. Dr. Gundry superintended the building of two or more large asylums, and was author of numerous reports on improving the care of the insane. After his removal to the vicinity of Baltimore, he accepted the chair of Materia Medica, Therapeutics, and Mental Diseases in the college above named. His final illness was due to Bright's disease. He was elected to membership in the American Public Health Association in 1878. He was a member of the faculty of the Baltimore College of Physicians and Surgeons. His death occurred at Spring Grove, Md., on April 23, 1891.

REPORT OF THE ADVISORY COUNCIL.

At a meeting of the Advisory Council of the American Public Health Association, held at Kansas City, Mo., Oct. 22, 1891, a quorum being present, it was decided to recommend Mexico City as the place for holding the next annual meeting. The following were nominated for the officers of the ensuing year:

For President.

DR. FELIX FORMENTO, of Louisiana.

For First Vice-President.

DR. DOMINGO ORVAÑANOS, of Mexico.

For Second Vice-President.

DR. WALTER WYMAN, of Washington, D. C.

For Treasurer.

DR. J. B. LINDSLEY, of Tennessee.

Members of the Executive Committee.

DRS. FRANCISCO MARIN of Mexico, J. D. PLUNKET of Tennessee, and J. N. MCCORMACK of Kentucky.

The following resolution from the Executive Committee was recommended to the Association for adoption:

Resolved, That this Association will hold its meeting in 1893 in the city of Chicago, and that, so far as possible, the occasion be made an International Congress of Hygiene and Public Health.

And the Council further advises that Drs. Rauch, Bell, Abbott, Bryce, Hewitt, Salomon, and Fraser be appointed a committee to arrange for said meeting.

J. N. MCCORMACK, *Secretary Advisory Council.*

ANNUAL REPORT OF THE TREASURER OF THE AMERICAN PUBLIC HEALTH ASSOCIATION.

October 20, 1891.

RECEIPTS.

From annual fees of members,	$1,670.00	
From sale of publications,	174.42	
Total,		$1,844.42

DISBURSEMENTS.

For printing, binding, and distributing Vol. XVI of *Public Health*,	$1,160.03	
Secretary's help,	250.00	
Secretary's office expenses and travel,	160.35	
Treasurer's travelling and office expenses,	223.70	
Total,		$1,794.08
Balance to new account,		$50.34

NOTE. The balance on hand December 16, 1891, $1,123.98 was appropriated to compiling and printing the index volume.

The above expenditures were ordered by the Executive Committee, and vouchers for the same are herewith submitted.

Very respectfully,

J. BERRIEN LINDSLEY, *Treasurer.*

Kansas City, Mo., Oct. 20, 1891.

We have examined all the bills and vouchers of the treasurer, and find them correct.

R. HARVEY REED,
MAURICE PERKINS,
SAMUEL H. DURGIN,
Auditing Committee.

CONSTITUTION

OF THE

AMERICAN PUBLIC HEALTH ASSOCIATION.

TITLE.

I. This Association shall be called "The American Public Health Association."

OBJECTS.

II. The objects of this Association shall be the advancement of sanitary science, and the promotion of organizations and the measures for the practical application of public hygiene.

MEMBERS.

III. The members of this Association shall be known as Active and Associate. The Executive Committee shall determine for which class a candidate shall be proposed. The *Active* members shall constitute the permanent body of the Association, subject to the provisions of the constitution as to continuance in membership. They shall be selected with special reference to their acknowledged interest in or devotion to sanitary studies and allied science, and to the practical application of the same. The *Associate* members shall be elected with special reference to their general interest only in sanitary science, and shall have all the privileges and publications of the Association, but shall not be entitled to vote.

Delegates from national, state, provincial, and municipal boards of health, organized sanitary associations, and the army, navy, and marine hospital service, shall be entitled to be enrolled as active members upon presentation of their credentials to the Executive Committee. Members, not delegates from such bodies, shall be elected as follows:

Each candidate for admission shall first be proposed to the Executive Committee, in writing (which may be done at any time), with a statement of the business or profession and special qualifications of the person so proposed. On recommendation of a majority of the committee, and on receiving a vote of two thirds of the members present at the regular meeting, the candidate shall be declared duly elected a member of the Association. The annual fee of membership in either class shall be five dollars.

OFFICERS.

IV. The officers shall be a President, a First and a Second Vice-President, a Secretary, and a Treasurer.

All the officers shall be elected by ballot, annually, except the Secretary, who shall be elected for a term of three years.

PRESIDING OFFICER.

V. The President, or in his absence one of the Vice-Presidents, or in their absence a chairman *pro tempore*, shall preside at all meetings of the Association. He shall preserve order, and shall decide all questions of order, subject to appeal to the Association. He shall also appoint all committees authorized by the Association, unless otherwise specially ordered.

SECRETARY.

VI. The Secretary shall have charge of the correspondence and records of the Association; and he shall also perform the duties of Librarian. He, together with the presiding officer, shall certify all acts of the Association. He shall, under the direction of the Executive Committee, give due notice of the time and place of all meetings of the Association, and attend the same. He shall keep fair and accurate records of all the proceedings and orders of the Association; and shall give notice to the several officers, and to the Executive and other committees of all votes, orders, resolves, and proceedings of the Association, affecting them or appertaining to their respective duties.

TREASURER.

VII. The Treasurer shall collect and take charge of the funds and securities of the Association. Out of these funds he shall pay such sums only as may be ordered by the Association, or by the Executive Committee. He shall keep a true account of his receipts and payments, and at each annual meeting render the same to the Association, when a committee shall be appointed to audit his accounts. If, from the annual report of the Treasurer, there shall appear to be a balance against the treasury, no appropriation of money shall be made for any object but the necessary current expenses of the Association, until such balance shall be paid.

STANDING COMMITTEES.

VIII. There shall be the following standing committees: (1) The Executive Committee, (2) the Advisory Council, (3) the Committee on Publication.

EXECUTIVE COMMITTEE.

IX. The Executive Committee shall consist (1) of the President, First Vice-President, Second Vice-President, Secretary, and Treasurer; (2) of six active members, of whom three shall be elected annually by ballot, to serve two years, and who shall be ineligible to reëlection for a second successive term; and (3) of the ex-Presidents of the Association.

It shall be the duty of the Executive Committee to consider and recommend plans for promoting the objects of the Association, to authorize the disbursement and expenditure of unappropriated moneys in the treasury for the payment of current expenses; to consider all applications for membership, and, at the regular meetings, report the names of such candidates as a majority shall approve; and, generally, to superintend the interests of the Association and execute all such duties as may, from time to time, be committed to them by the Association. At least one month preceding the annual meeting of the Association, the Executive Committee shall cause to be issued to members a notice of such meeting, and they are authorized to publish the same in medical, scientific, and other periodicals, but without expense to the Association; and such notice shall contain the order of business to be followed at said meeting, and, briefly, the subjects to be presented and the special points of discussion.

ADVISORY COUNCIL.

X. The Advisory Council shall consist of one member from each state, territory, and district, the army, navy, and marine hospital service, the Dominion of Canada, and each of the Provinces, who shall be appointed by the President on the last day of each session, and who, besides acting as nominating committee of officers for the ensuing year, to be announced at such time as the Executive Committee may appoint, shall consider such questions and make such recommendations to the Association as shall best secure the objects of the Association. They shall at their first meeting elect from their own number a Secretary, whose record of their proceedings shall be made part of the records of the Association.

COMMITTEE ON PUBLICATION.

XI. The Committee on Publication shall consist of the Secretary and two active members, selected by the Executive Committee, who shall contract for, arrange, and publish, under authority of the Executive Committee, the proceedings of the Association, including such papers as have been examined and approved by the Executive Committee, or which have been submitted to them by the latter for their discretionary action.

REPORTS AND PAPERS.

XII. All committees, and all members preparing scientific reports of papers to be laid before the Association at its annual meetings, must give, in writing, the title of such reports or papers, the time to be occupied in reading them, and an abstract of their contents, to the Executive Committee, at least one week preceding the date of such meeting, to secure their announcement in the order of business.

MEETINGS.

XIII. The time and place of each annual meeting shall be fixed at the preceding annual meeting, but may be changed by the Executive Committee for reasons that shall be specified in the announcement of the meeting. Special meetings may be called, at any time or place, by concurrence of two thirds of the Executive Committee. There shall be no election of officers, or change of By-Laws, or appropriation of money to exceed the amount at that time in the treasury, at such special meeting, except by a vote of a majority of all the members of the Association. Whenever a special meeting is to be held, at least one month's notice shall, if possible, be given by circular to all the members, together with the order of business.

QUORUM.

XIV. At the annual meeting nine members shall constitute a quorum for the election of officers, a change of the constitution, the election of members, and the appropriation of moneys.

ORDER OF BUSINESS.

XV. The order of business at all meetings of the Association shall be fixed by the Executive Committee, and such order must be completed before any other business is introduced, except such order of business is suspended by a vote of four fifths present.

ALTERATION OF CONSTITUTION.

XVI. No alteration in the Constitution of the Association shall be made except at an annual meeting, or unless such alteration shall have been proposed at a previous meeting, and entered on the minutes with the name of the member proposing the same, and shall be adopted by a vote of two thirds of the members present.

BY-LAWS OF THE EXECUTIVE COMMITTEE.

QUORUM.

1. Five members shall constitute a quorum for the transaction of such business as may come before the committee.

MEMBERS RESTRICTED.

2. No elective member of the Executive Committee shall be at the same time a member of the Advisory Council, if there is another member of the Association from his state or service.

PARLIAMENTARY USAGE.

3. Cushing's Law and Practice of Legislative Assemblies shall be the guide of parliamentary practice until otherwise ordered.

PAPERS.

4. All papers presented to the Association must be either printed, typewritten, or in plain handwriting, and be in the hands of the Secretary at least twenty days prior to the annual meeting, to insure their critical examination as to their fulfilling the requirements of the Association.

5. If any paper is too late for critical examination, said paper may be so far passed upon by the Executive Committee as to allow its reading, but such paper shall be subject to publication or non-publication, as the Executive Committee deem expedient.

6. All papers accepted by the Association, whether read in full, by abstract, by title, or filed, shall be delivered to the Secretary as soon as thus disposed of, as the exclusive property of the Association. Any paper presented to this Association and accepted by it shall be refused publication in the transactions of the Association, if it be published, in whole or in part, by permission or assent of its author, in any manner prior to the publication of the volume of transactions, unless written consent is obtained from the Publication Committee.

7. Day papers shall be limited to twenty minutes, and evening papers to thirty minutes, each.

DISCUSSION OF PAPERS.

8. After the leading papers on each subject, as indicated by the Executive Committee, have been read, discussion shall follow, and be confined strictly to the subject of these papers; and each speaker shall be limited to ten minutes, and shall not speak a second time until after every other member who desires to be heard, and then only for five minutes, except by unanimous consent.

9. The Chair shall notify gentlemen who desire to speak to send up their names, and they shall be called on in the order sent up; and he may, at his discretion, limit the time of speaking to five instead of ten minutes, if in his judgement it may become necessary to do so in order to allow each one on the list an opportunity to be heard.

PUBLICATION COMMITTEE.

10. The Committee on Publication, charged with the duties of selecting and printing the papers and transactions of the Association, shall consist of three active members of the Association, and of whom one shall be the Secretary, appointed by the Executive Committee during the session of the Association, and selected with reference to their facilities of meeting.

11. All papers read by title, and others not definitely passed upon by the Executive Committee, shall be referred to the Publication Committee for critical examination; and said committee is authorized to reject such papers as in its judgment are not worthy of publication, and to omit such others as cannot be included within the limits of the annual volume.

12. The Publication Committee shall procure a copyright on the transactions in the name of the Association, and the committee shall have full charge of the publication of the transactions.

APPLICATION FOR MEMBERSHIP.

13. All applications for membership must be made upon the application blank of the Association.

14. Persons not members, having prepared papers to be presented at the meetings of the Association, shall be proposed for membership at the first business meeting of the Association.

EXPENDITURES.

15. All bills connected with the publication of the transactions shall, upon the approval of the chairman of the Publication Committee and the Secretary, be signed by the President of the Association, and paid by check of the Treasurer directly to the party concerned; and the President shall not approve any bill, relating either to publishing or printing,

without the approval first of the chairman of the committee in charge thereof.

16. Bills for current expenses shall be first approved by the Secretary, then sent to the President, and on his approval they shall be paid by check of the Treasurer directly to the parties interested.

17. The actual and necessary travelling expenses of the Secretary and Treasurer to the annual meeting of the Association, and to one meeting of the Executive Committee, shall be classed as current expenses.

RESOLUTIONS.

18. All resolutions presented to the Association shall be sent to the Chair in writing, and referred to a committee without discussion.

ARREARAGES.

19. The arrearages of all members remitting their dues for two years shall be cancelled up to the date of the last payment, but they shall be entitled to the transactions of the Association only for the years for which they have actually paid.

AUDITING COMMITTEE.

20. An Auditing Committee shall be appointed by the Chair to audit the accounts of the Treasurer, and report upon the same.

OFFICERS AND COMMITTEES

OF THE

AMERICAN PUBLIC HEALTH ASSOCIATION.

ORGANIZATION, 1891–1892.

President, ... Dr. FELIX FORMENTO, *New Orleaus, La.*
First Vice-President, . Dr. DOMINGO ORVAÑANOS, *Mexico, Mex.*
Second Vice-President, Dr. WALTER WYMAN, *Washington, D. C.*
Secretary, ... Dr. IRVING A. WATSON, *Concord, N. H.*
Treasurer, ... Dr. J. BERRIEN LINDSLEY, *Nashville, Tenn.*

(*Ex-officio* members Executive Committee.)

STANDING COMMITTEES.

EXECUTIVE COMMITTEE.

(Elective.)

Dr. A. W. CANTWELL . . . . . *Davenport, Ia.*
Dr. EDWARD CLARK . . . . . *Buffalo, N. Y.*
Prof. W. W. DANIELLS . . . . . *Madison, Wis.*
Dr. FRANCISCO MARIN . . . . . *Puebla, Mexico.*
Dr. J. D. PLUNKET . . . . . *Nashville, Tenn.*
Dr. J. N. MCCORMACK . . . . . *Bowling Green, Ky.*

(The ex-Presidents, *ex-officio* members Executive Committee.)

Prof. STEPHEN SMITH . . . . . *New York City.*
Dr. JOSEPH M. TONER . . . . . *Washington, D. C.*
Dr. JOHN H. RAUCH . . . . . *Chicago, Ill.*
Major JOHN S. BILLINGS . . . . . *U. S. Army.*
Prof. ROBERT C. KEDZIE . . . . . *Lansing, Mich.*
Dr. EZRA M. HUNT . . . . . *Trenton, N. J.*
Dr. ALBERT L. GIHON . . . . . *U. S. Navy.*
Dr. JAMES E. REEVES . . . . . *Chattanooga, Tenn.*
Dr. HENRY P. WALCOTT . . . . . *Cambridge, Mass.*
Major GEORGE M. STERNBERG . . . . . *U. S. Army.*
Dr. CHARLES N. HEWITT . . . . . *Red Wing, Minn.*
Dr. HENRY B. BAKER, ... *Lansing, Mich.*
Dr. FREDERICK MONTIZAMBERT . . . . . *Quebec, Canada.*

ADVISORY COUNCIL.

UNITED STATES:

Alabama, ... Dr. JEROME COCHRAN, *Mobile.*
Arkansas, ... Dr. H. C. DUNNAVANT, *Osceola.*
California, ... Dr. P. C. REMONDINO, *San Diego.*
Colorado, ... Dr. HENRY K. STEELE, *Denver.*
Connecticut, ... Prof. C. A. LINDSLEY, *New Haven.*
Delaware, ... Dr. LEWIS P. BUSH, *Wilmington.*

Florida,	Dr. Joseph Y. Porter, *Key West.*
Georgia,	Dr. William F. Brunner, *Savannah.*
Illinois,	Dr. John H. Rauch, *Chicago.*
Indiana,	Dr. James F. Hibberd, *Richmond.*
Iowa,	Dr. Joel W. Smith, *Charles City.*
Kansas,	Dr. Daniel C. Jones, *Topeka.*
Kentucky,	Dr. Wm. Bailey, *Louisville.*
Louisiana,	Dr. Lucien F. Salomon, *New Orleans.*
Maine,	E. C. Jordan, C. E., *Portland.*
Maryland,	Dr. John Morris, *Baltimore.*
Massachusetts,	Dr. S. H. Durgin, *Boston.*
Michigan,	Dr. Henry B. Baker, *Lansing.*
Minnesota,	Dr. Charles N. Hewitt, *Red Wing.*
Mississippi,	Dr. Wirt Johnston, *Jackson.*
Missouri,	Dr. Eugene R. Lewis, *Kansas City.*
Nebraska,	Dr. Clarke Gapen, *Omaha.*
New Hampshire,	Dr. Granville P. Conn, *Concord.*
New Jersey,	Dr. Ezra M. Hunt, *Trenton.*
New Mexico,	Dr. James H. Wroth, *Albuquerque.*
New York,	Dr. A. N. Bell, *Brooklyn.*
North Carolina,	Dr. Henry I. Bahnson, *Salem.*
North Dakota,	Dr. O. Wellington Archibald, *Jamestown.*
Ohio,	Dr. R. Harvey Reed, *Columbus.*
Oklahoma Ter.,	Dr. Charles F. Waldron, *Oklahoma City.*
Pennsylvania,	Mr. Crosby Gray, *Pittsburgh.*
Rhode Island,	Dr. Charles H. Fisher, *Providence.*
South Carolina,	Dr. H. B. Horlbeck, *Charleston.*
South Dakota,	Dr. K. M. O. Teigen, *Fargo.*
Tennessee,	Dr. S. A. Rogers, *Nashville.*
Texas,	Dr. R. M. Swearingen, *Austin.*
Vermont,	Dr. J. H. Hamilton, *Richford.*
Virginia,	Dr. J. Grattan Cabell, *Richmond.*
West Virginia,	Dr. C. T. Richardson, *Charleston.*
Wisconsin,	Dr. J. T. Reeve, *Appleton.*
Dist. of Columbia,	D. E. Salmon, D. V. M., *Washington.*
U. S. Army,	Major Charles Smart, *Washington, D. C.*
U. S. Navy,	Medical Director Albert L. Gihon, *Brooklyn, N. Y.*
U. S. M. H. Service,	Surgeon John Godfrey, *New York City.*

Canada:

Dominion of Canada,	Dr. Frederick Montizambert, *Quebec.*
Province of Ontario,	Dr. Peter H. Bryce, *Toronto.*
Province of Quebec,	Mr. Henry R. Gray, *Montreal.*
Manitoba,	Dr. Wm. R. D. Sutherland, *Winnipeg.*
New Brunswick,	Dr. Wm. S. Harding, *St. John.*

Mexico:

Federal District,	Dr. Eduardo Licéaga, *Mexico, Mex.*
Durango,	Dr. A. Gaviño, *Mexico, Mex.*
Guerrero,	Dr. Leopoldo Viramontes, *Chilpancingo.*
Guanajuato,	Dr. Jesus Chico, *Guanajuato.*
Morelos,	Dr. Nazario Lomas, *Cuernavaca.*
Nuevo Leon,	Dr. Pedro Noriega, *Monterey.*

Puebla, ... Dr. José M. Marin, *Puebla, Mex.*
Querétaro, ... Dr. Manuel Gutierrez, *Mexico, Mex.*
San Luis Potosí, . . . Dr. Jesus E. Monjaras, *San Luis Potosí.*
Sonora, ... Dr. Alberto Noriega, *Hermosillo.*
Tamaulipas, ... Dr. Ramon Icaza, *Mexico, Mex.*
Vera Cruz, ... Dr. Gregorio Mendizabal, *Orizava, Vera Cruz.*
Zacatecas, ... Dr. L. M. de Jesi, *Zacatecas.*

PUBLICATION COMMITTEE.

The Secretary, *ex officio.*
Dr. Granville P. Conn . . . . . *Concord, N. H.*
Dr. Samuel H. Durgin . . . . . *Boston, Mass.*

SPECIAL COMMITTEES.

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Dr. WALTER WYMAN, Superv'g Surgeon Gen'l, U. S. M. H. S., Washington, D. C.
Dr. C. P. WILKINSON . . . . . New Orleans, La.

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Dr. PETER H. BRYCE . . . . . Toronto, Ont.
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ON CAUSES AND PREVENTION OF INFANT MORTALITY.

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(With authority to select associates.)

ON RESTRICTION AND PREVENTION OF TUBERCULOSIS.

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Dr. SMITH TOWNSHEND . . . . . Washington, D. C.
Dr. HOWARD E. AMES . . . . . Washington, D. C.

TO ARRANGE FOR THE MEETING OF 1893.[1]

Dr. JOHN H. RAUCH . . . . . Chicago, Ill.
Dr. A. N. BELL . . . . . Brooklyn, N. Y.

[1]At the annual meeting of the Association, held at Kansas City, Mo., Oct. 20–23, 1891, the following resolution was adopted: *Resolved*, That this Association will hold its meeting in 1893 in the city of Chicago, and that, so far as possible, the occasion be made an International Congress of Hygiene and Public Health.

Dr. Samuel W. Abbott . . . . . Wakefield, Mass.
Dr. Peter H. Bryce . . . . . Toronto, Ont.
Dr. Charles N. Hewitt . . . . . Red Wing, Minn.
Dr. Lucien F. Salomon . . . . . New Orleans, La.
Dr. H. D. Fraser . . . . . Charleston, S. C.

ON THE CENTENNIAL OF VACCINATION.

Dr. Thomas F. Wood . . . . . Wilmington, N. C.
Dr. Joseph M. Toner . . . . . Washington, D. C.
Dr. T. Grange Simons . . . . . Charleston, S. C.
Prof. C. A. Lindsley . . . . . New Haven, Conn.
Dr. R. Harvey Reed . . . . . Mansfield, Ohio.

LOCAL COMMITTEE OF ARRANGEMENTS.

(To be announced.)

REVISED LIST OF MEMBERS

AMERICAN PUBLIC HEALTH ASSOCIATION,

1892.

This list includes all those who have maintained their membership to the present time, excepting those elected at Kansas City, which list will be found in another place. The Secretary should be notified of any errors or omissions.

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Stephen Smith, M. D.	1872, '73, '74
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*Edwin M. Snow, M. D.	1876
John H. Rauch, M. D.	1877
*Elisha Harris, M. D.	1878
*James L. Cabell, M. D.	1879
John S. Billings, M. D.	1880
*Charles B. White, M. D.	1881
Robert C. Kedzie, M. D.	1882
Ezra M. Hunt, M. D.	1883
Albert L. Gihon, M. D.	1884
James E. Reeves, M. D.	1885
Henry P. Walcott, M. D.	1886
George M. Sternberg, M. D.	1887
Charles N. Hewitt, M. D.	1888
*Hosmer A. Johnson, M. D.	1889
Henry B. Baker, M. D.	1890
Frederick Montizambert, M. D.	1891
Felix Formento, M. D.	1892

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Dr. Samuel W. Abbott	Wakefield, Mass.	1882
Julius W. Adams, C. E., Congress street	Brooklyn, N. Y.	1889
Dr. J. F. A. Adams	Pittsfield, Mass.	1881
C. H. Alden, U. S. A.	St. Paul, Minn.	1887
Dr. Willis G. Alling	New Haven, Conn.	1885
Dr. Charles D. Alton, 86 Farmington Ave.	Hartford, Conn.	1890

* Deceased.

Dr. Austin White Alvord	Battle Creek, Mich.	1887
Dr. Charles Ambrook	Boulder, Col.	1878
Dr. Azel Ames, Jr.	Chicago, Ill.	1875
Dr. A. A. Ames,	Minneapolis, Minn.	1887
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John A. Anderson	Lambertville, N. J.	1887
Prof. Edmund R. Angell, Chemist	Derry, N. H.	1889
George T. Angell, Esq.	Boston, Mass.	1878
Dr. O. W. Archibald	Jamestown, N. D.	1888
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Hon. Edward Atkinson.	Boston, Mass.	1889
V. T. Atkinson, V. S.	Milwaukee, Wis.	1888
Prof. W. O. Atwater	Washington, D. C.	1889
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Dr. T. G. Barnhill	Findlay, Ohio.	1882
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Dr. Frederick Becker	Clermont, Iowa.	1889
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Dr. Delavan Bloodgood, U. S. N.	Brooklyn, N. Y.	1890
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Dr. Frans H. Bodenius . . . . . Madison, Wis. 1888
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Frederick N. Boxer, C. E. . . . . Montreal, P. Q. 1885
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Prof. William H. Brewer . . . . . New Haven, Conn. 1874
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Dr. William Francis Brunner, Health Officer, 50 Harris St. . . . . Savannah, Ga. 1890
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Dr. J. Grattan Cabell . . . . . Richmond, Va. 1873
Dr. Allan Cameron . . . . . Owen Sound, Ont. 1886
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Dr. William Canniff . . . . . Toronto, Ont. 1883
Dr. G. M. D. Cantrell . . . . . Little Rock, Ark. 1881
Dr. A. W. Cantwell . . . . . Davenport, Iowa. 1880
Dr. H. R. Carter, U. S. M. H. S. . . . . Washington, D. C. 1890
Prof. Stanford E. Chaillé . . . . . New Orleans, La. 1874
Dr. Charles W. Chancellor . . . . . Baltimore, Md. 1875
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Dr. Charles V. Chapin . . . . . Providence, R. I. 1886
Dr. Walter H. Chapin . . . . . Springfield, Mass. 1889
John C. Chase, C. E., Supt. of Water-Works . . Wilmington, N. C. 1890
Dr. Thomas Teasdale Church, Health Officer, 70 E. Main St. . . . . Salem, Ohio. 1890
Hon. J. W. Clapp . . . . . Memphis, Tenn. 1879
Dr. Edwin Clark . . . . . Buffalo, N. Y. 1888
Dr. A. P. Clarke . . . . . Cambridge, Mass. 1887
Dr. E. F. X. Cleveland . . . . . Dundee, Ill. 1887
Dr. A. A. Clough . . . . . Denver, Col. 1889
Dr. Jerome Cochran . . . . . Mobile, Ala. 1878
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Dr. Edward W. Cole . . . . . Nashville, Tenn. 1887
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Dr. G. P. Conn . . . . . Concord, N. H. 1875
Dr. P. S. Conner . . . . . Cincinnati, Ohio. 1884
Dr. Henry J. Connor . . . . . West Superior, Wis. 1888
Dr. Isaac Cooper, 194 Broad St. . . . . Trenton, N. J. 1889
Hon. W. F. Cooper . . . . . New York City. 1879

Dr. JOHN C. CORBUS . . . . . Mendota, Ill. 1889
JULIUS COTZ, S. E. . . . . Atlantic City, N. J. 1889
Dr. W. T. COUNCILMAN . . . . . Baltimore, Md. 1887
Dr. JOHN COVENTRY . . . . . Windsor, Ont. 1886
Dr. C. W. COVERNTON . . . . . Toronto, Ont. 1884
Dr. G. G. CRAIG . . . . . Rock Island, Ill. 1880
J. JAMES R. CROES, C. E., 13 William St. . . . . New York City. 1877
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Dr. F. C. CURTIS . . . . . Albany, N. Y. 1883
Dr. CHARLES O. CURTMAN . . . . . St. Louis, Mo. 1884
Dr. JACOB M. DACOSTA . . . . . Philadelphia, Pa. 1874
Dr. J. P. DAKE . . . . . Nashville, Tenn. 1879
Dr. R. P. DANIELL . . . . . Jacksonville, Fla. 1890
Prof. W. W. DANIELLS . . . . . Madison, Wis. 1886
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CHESTER B. DAVIS, C. E., The Rookery . . . . . Chicago, Ill. 1886
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Dr. DWIGHT W. DAY . . . . . Eau Claire, Wis. 1888
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DAVID B. DICK . . . . . Toronto, Ont. 1886
HON. PEREZ DICKINSON . . . . . Knoxville, Tenn. 1881
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Dr. H. C. DUNNAVANT . . . . . Osceola, Ark. 1882
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Dr. CYRUS EDSON, 54 W. 9th St. . . . . New York City. 1889
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Dr. Edward F. Elbridge . . . . . New London, Wis. 1888
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Dr. L. A. Falligant . . . . . Savannah, Ga. 1881
Dr. Edwin Farnham . . . . . Cambridge, Mass. 1889
A. B. Farquhar, Esq. . . . . York, Pa. 1880
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Dr. James B. Field . . . . . Lowell, Mass. 1889
Dr. J. D. Fields . . . . . Manor, Tex. 1880
Dr. Charles H. Fisher . . . . . Providence, R. I. 1881
Gustave Fleischmann . . . . . Buffalo, N. Y. 1888
Henry A. Fleischmann, 1541 Madison Ave. . . . New York City. 1888
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William S. French, C. E. . . . . West Newton, Mass. 1889
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Dr. John F. Fulton . . . . . St. Paul, Minn. 1888
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Dr. J. D. Gatch . . . . . Lawrenceburg, Ind. 1879
Dr. Franklin Gauntt . . . . . Burlington, N. J. 1885
Dr. John B. C. Gazzo . . . . . Thibodeaux, La. 1887
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William Paul Gerhard, C. E., 39 Union Sq. W. . New York City. 1880
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Prof. Wolcott Gibbs . . . . . Newport, R. I. 1876
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Dr. R. S. Goodwin, ... Thomaston, Conn. 1886
Dr. John H. Granniss . . . . . Old Saybrook, Conn. 1889
Dr. E. E. Graves . . . . . Boscawen, N. H. 1886
Crosby Gray . . . . . Pittsburgh, Pa. 1874
Henry R. Gray, 144 St. Lawrence Main . . . . . Montreal, P. Q. 1886

Dr. JOHN J. GREEN . . . . . Pittsburgh, Pa. 1884
Gen. COLTON GREENE . . . . . Memphis, Tenn. 1880
Dr. WALTER D. GREENE, Health Officer . . . . . Buffalo, N. Y. 1890
Dr. JAMES G. GREGORY . . . . . Norwalk, Conn. 1889
Dr. EDGERTON GRIFFIN . . . . . Brantford, Ont. 1886
Dr. JOHN GRIFFIN, 90 Sands St. . . . . Brooklyn, N. Y. 1888
ROBERT GRIFFITH, 427 Clark St. . . . . Chicago, Ill. 1890
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Dr. J. C. GRONVOLD . . . . . Norway, Minn. 1886
Dr. EDWARD A. GUILBERT . . . . . Dubuque, Iowa. 1890
Dr. P. J. GUILLOT . . . . . Bushkill, Pa. 1887
Dr. ALEXANDER HADDEN, 155 E. 51st St. . . . . New York City. 1889
Hon. D. P. HADDEN . . . . . Memphis, Tenn. 1880
Dr. JUNIUS M. HALL . . . . . Chicago, Ill. 1880
Dr. LUCY M. HALL, 181 Joralemon St. . . . . Brooklyn, N. Y. 1889
Dr. JOHN B. HAMILTON, Sherman House . . . . . Chicago, Ill. 1886
Dr. R. A. HARDIN . . . . . Savannah, Ga. 1879
Dr. W. S. HARDING . . . . . St. John, N. B. 1886
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Dr. HENRY HARTSHORNE . . . . . Germantown, Pa. 1872
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Dr. ARTHUR HAZELWOOD . . . . . Grand Rapids, Mich. 1889
J. M. HAZEN, 1512 Park Ave. . . . . Minneapolis, Minn. 1889
RUDOLPH HERING, C. E., 277 Pearl St. . . . . New York City. 1878
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Dr. J. F. HIBBERD . . . . . Richmond, Ind. 1881
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Prof. EDWARD HITCHCOCK . . . . . Amherst. Mass. 1877
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Dr. JOSEPH HOLT . . . . . New Orleans, La. 1880
Dr. HENRY D. HOLTON . . . . . Brattleboro, Vt. 1875
Dr. GEORGE HOMAN, 919 Olive St. . . . . St. Louis, Mo. 1879
Dr. H. B. HORLBECK . . . . . Charleston, S. C. 1880
Dr. ASA HORR . . . . . Dubuque, Iowa. 1872
Dr. HENRY F. HOYT . . . . . St. Paul, Minn. 1884
Dr. WILLIAM H. HUGER, Physician to Orphans' Home Charleston, S. C. 1890
Dr. A. CLARK HUNT . . . . . Metuchen, N. J. 1888
Dr. C. C. HUNT . . . . . Dixon, Ill. 1889
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Dr. FRED N. HUNT . . . . . Fairmont, Minn. 1889
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Dr. C. H. HUNTER . . . . . Minneapolis, Minn. 1888
Dr. RANDALL R. HUNTER, City Chemist . . . . Kansas City, Mo. 1890
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Dr. ALEXANDER HUTCHINS, 796 De Kalb Ave. . . . Brooklyn, N. Y. 1889
Dr. JOHN W. JACKSON . . . . . Kansas City, Mo. 1884

Dr. R. N. Jackson . . . . . Faribault, Minn. 1889
Rev. D. C. Jacokes, S. T. D. . . . . Pontiac, Mich. 1882
Dr. Bushrod W. James, cor. 18th and Green Sts. . Philadelphia, Pa. 1878
Dr. Edward H. Janes, 301 Mott St. . . . . New York City. 1872
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Dr. Andrew J. B. Jenner . . . . . Detroit, Mich. 1883
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Dr. Sam C. Johnson . . . . . Hudson, Wis. 1884
Dr. Wirt Johnston . . . . . Jackson, Miss. 1878
Dr. D. C. Jones . . . . . Topeka, Kan. 1887
Dr. E. Utley Jones . . . . . Taunton, Mass. 1881
Dr. H. Isaac Jones, 118 Grant Ave. . . . . San Francisco, Cal. 1880
Dr. J. W. Jones . . . . . Tarborough, N. C. 1885
Dr. Leander P. Jones . . . . . Greenwich, Conn. 1889
Edward C. Jordan, C. E. . . . . Portland, Me. 1886
Hon. J. M. Keating . . . . . Memphis, Tenn. 1880
Dr. Robert C. Kedzie . . . . . Lansing, Mich. 1873
Dr. J. H. Kellogg . . . . . Battle Creek, Mich. 1878
George T. Kemp, Ph. D., 173 Joralemon St. . . . Brooklyn, N. Y. 1889
Dr. J. F. Kennedy . . . . . Des Moines, Iowa. 1885
Dr. Isaac N. Kerlin . . . . . Elwyn, Pa. 1874
Dr. Samuel S. Kilvington, ... Minneapolis, Minn. 1887
Dr. G. M. Kimball . . . . . Concord, N. H. 1886
Dr. Charles F. King . . . . . Hudson, Wis. 1888
Dr. William F. Knox . . . . . McKeesport, Pa. 1887
Dr. Cornelius Kollock . . . . . Cheraw, S. C. 1884
Emil Kuichling, C. E. . . . . Rochester, N. Y. 1882
Dr. Louis Laberge . . . . . Montreal, P. Q. 1886
Dr. Emanuel P. Lachapelle . . . . . Montreal, P. Q. 1887
Dr. S. W. Latta . . . . . Trenton, N. J. 1885
Prof. James Law . . . . . Ithaca, N. Y. 1872
Dr. Benjamin Lee, 1522 Pine St. . . . . Philadelphia, Pa. 1874
Dr. William Lee, 2111 Penn. Ave. . . . . Washington, D. C. 1874
Dr. Henry Leffman, 715 Walnut St. . . . . Philadelphia, Pa. 1884
L. Z. Leiter, Esq., P. O. Drawer L. . . . . Chicago, Ill. 1876
William T. Lemp . . . . . St. Louis, Mo. 1884
Dr. B. B. Lenoir . . . . . Lenoir's, Tenn. 1879
Hon. William P. Lethworth . . . Glen Iris, Portageville, N. Y. 1874
Dr. John B. Lerned . . . . . Florence, Mass. 1889
Wallace G. Levison, 317 Livingston St. . . . . Brooklyn, N. Y. 1889
Dr. Philip W. Lewellyn . . . . . Clarinda, Iowa. 1890
Dr. Henry M. Lewis, 171 Remsen St. . . . . Brooklyn, N. Y. 1889
Dr. H. H. Levy . . . . . Richmond, Va. 1878
Dr. Eugene R. Lewis . . . . . Kansas City, Mo. 1884
Dr. Francis W. Lewis, 2016 Spruce St. . . . . Philadelphia, Pa. 1874
Dr. Charles A. Lindsley . . . . . New Haven, Conn. 1875
Dr. J. Berrien Lindsley . . . . . Nashville, Tenn. 1877
Dr. J. M. Lindsley . . . . . Nashville, Tenn. 1879

Dr. JOHN B. LINEHAM, 301 Mott St.	New York City.	1889
JAMES L. LORING, C. E.	Dallas Centre, Iowa.	1890
Dr. CHAUNCEY E. LOW, 110 Remsen St.	Brooklyn, N. Y.	1889
Hon. SETH LOW, 201 Columbia Heights	Brooklyn, N. Y.	1889
HARVEY C. LOWRIE, C. E.	Denver, Col.	1886
ALAN MACDOUGALL, C. E.	Toronto, Ont.	1886
Dr. HUGH W. MACKAY	Woodstock, Ont.	1889
WILLIAM S. MACHARG, C. E., 14 Pacific Ave.	Chicago, Ill.	1889
Dr. JAMES H. MADDOX	Stafford, Miss.	1887
Dr. G. E. MANIGAULT	Charleston, S. C.	1890
Dr. SOLON MARKS	Milwaukee, Wis.	1876
Dr. ALBERT MAROIS, 51 St. Louis St.	Quebec, P. Q.	1889
Dr. E. J. MARSH	Paterson, N. J.	1872
EDWARD F. MARTIN, 301 Mott St.	New York City.	1889
Dr. ROBERT MARTIN	Milwaukee, Wis.	1885
CHARLES D. MARX, C. E., Leland Stanford, Jr., University	Palo Alto, Cal.	1886
Dr. JOHN E. MASON, 2106 H. St. N. W.	Washington, D. C.	1885
Dr. GEORGE T. MAXWELL	Jacksonville, Fla.	1889
Dr. EZRA S. MCCLELLAN	Paterson, N. J.	1889
Dr. J. H. MCCLELLAND	Pittsburgh, Pa.	1885
Dr. J. H. MCCOLLOM, 57 Dwight St.	Boston, Mass.	1884
Dr. J. N. MCCORMACK	Bowling Green, Ky.	1880
Dr. JOHN R. MCDILL	Milwaukee, Wis.	1888
Dr. CALVIN D. MCDONALD	Kansas City, Mo.	1889
Dr. L. D. MCINTOSH, 141 Wabash Ave.	Chicago, Ill.	1888
Dr. W. PAGE MCINTOSH, U. S. M. H. S., U. S. Quarantine Station	San Francisco, Cal.	1885
W. P. MCLAREN, Esq.	Milwaukee, Wis.	1888
Dr. JOHN T. MCLEAN	Alameda, Cal.	1889
Hon. ALBERT L. MCNEAL	Bolivar, Tenn.	1879
Dr. ALLARD MEMMINGER	Charleston, S. C.	1890
Dr. ALFRED MERCER	Syracuse, N. Y.	1886
Hon. GEORGE A. MERCER	Savannah, Ga.	1881
Dr. CHARLES N. METCALF	Indianapolis, Ind.	1885
HENRY C. MEYER, C. E.	New York City.	1882
Dr. MIDDLETON MICHEL	Charleston, S. C.	1890
Prof. JOHN B. MINOR	University of Virginia, Va.	1878
ANDREW S. MITCHELL	Milwaukee, Wis.	1888
Dr. CHARLES MITCHELL	Nashville, Tenn.	1884
Dr. HENRY MITCHELL	Asbury Park, N. J.	1886
Dr. R. W. MITCHELL	Memphis, Tenn.	1878
Dr. JOHN L. MOFFAT, 17 Schermerhorn St.	Brooklyn, N. Y.	1889
Dr. RUBEN C. MOFFAT, 17 Schermerhorn St.	Brooklyn, N. Y.	1889
C. MONJEAU	Cincinnati, O.	1887
Dr. L. H. MONTGOMERY	Chicago, Ill.	1879
Dr. FREDERICK MONTIZAMBERT	Grosse Isle, Quebec, P. Q.	1885
Dr. J. FRED MOORE, 444 Pacific St.	Brooklyn, N. Y.	1886
ROBERT MOORE, C. E.	St. Louis, Mo.	1880

Dr. Emma W. Mooers . . . . . Arlington, Mass. 1888
David Percy Morgan, 50 Trinity Building, Broadway New York City. 1885
Dr. John Morris . . . . . Baltimore, Md. 1874
Dr. J. Cheston Morris, 1514 Spruce St. . . . . Philadelphia, Pa. 1883
Dr. Prince A. Morrow, 66 W. 40th St. . . . . New York City. 1889
William F. Morse, S. E., 30 State St. . . . . New York City. 1889
Dr. Eliza M. Mosher, 181 Joralemon St. . . . . Brooklyn, N. Y. 1889
Dr. Byron Wooster Munson . . . . . Noroton, Conn. 1889
Alexander W. Murray, 811 W. Madison St. . . . . Chicago, Ill. 1884
Dr. Robert D. Murray, U. S. M. H. S. . . . . Key West, Fla. 1872
Dr. R. D. Mussey . . . . . Glendale, Ohio. 1889
Dr. John T. Nagle, 301 Mott St. . . . . New York City. 1874
Dr. A. Nash . . . . . Joliet, Ill. 1887
Dr. Herbert M. Nash . . . . . Norfolk, Va. 1878
Dr. William K. Newton . . . . . Paterson, N. J. 1883
Dr. Frank P. Norbury . . . . . Jacksonville, Ill. 1889
Dr. R. J. Nunn . . . . . Savannah, Ga. 1881
Dr. M. C. O'Connor . . . . . New Haven, Conn. 1888
Dr. Max Ohlemann . . . . . Milwaukee, Wis. 1888
Dr. William Oldright . . . . . Toronto, Ont. 1883
Frederick Law Olmstead, Esq. . . . . Brookline, Mass. 1872
Dr. H. S. Orme . . . . . Los Angeles, Cal. 1885
Prof. Edward Orton . . . . . Columbus, Ohio. 1874
Dr. Domingo Orvañanos, Member Superior Board of Health, 20 Juan Manuel St. . . Federal District, Mexico, Mex. 1890
Michael J. O'Shaughnessy . . . . . Huntsville, Ala. 1879
Dr. William C. Otterson, 144 Pierrepont St. . . . Brooklyn, N. Y. 1887
F. N. Owen, C. E., 13 William St. . . . . New York City. 1883
Dr. William O. Owen . . . . . Plattsburgh, N. Y. 1887
Dr. Frank K. Paddock . . . . . Pittsfield, Mass. 1889
Dr. A. H. Paquet . . . . . St. Cuthbert, P. Q. 1889
Dr. J. M. Partridge . . . . . South Bend, Ind. 1881
Dr. George Peck, U. S. Navy, 926 N. Broad St. . . Elizabeth, N. J. 1890
Dr. Ozias W. Peck . . . . . Oneonta, N Y. 1887
Dr. C. T. Peckham, U. S. M. H. S. . . . . St. Louis, Mo. 1887
Henry E. Pellew, Esq. . . . . Katonah, N. Y. 1876
Dr. Maurice Perkins . . . . . Schenectady, N. Y. 1888
Dr. D. L. Phares . . . . . Agricultural College, Miss. 1880
Dr. Hugo Philler . . . . . Waukesha, Wis. 1888
Dr. J. H. Phillips . . . . . Preston, Minn. 1890
Hon. Edwin L. Pillsbury, 12 Beacon St. . . . . Boston, Mass. 1889
Dr. Edward Playter . . . . . Ottawa, Ont. 1886
Dr. Samuel C. Plummer . . . . . Rock Island, Ill. 1888
Dr. J. D. Plunket . . . . . Nashville, Tenn. 1878
Miss Emma C. G. Polson . . . . . New Haven, Conn. 1888
Dr. Joseph Y. Porter, U. S. A. . . . . Key West, Fla. 1878
Dr. Thomas K. Powell . . . . . Dancyville, Tenn. 1879
Dr. Charles W. Preston, 570 Leonard St. . . . . Brooklyn, N. Y. 1888

Dr. C. O. Probst . . . . . Columbus, Ohio. 1886
Dr. Francis Rae . . . . . Oshawa, Ont. 1886
Dr. J. B. Ralph . . . . . Omaha, Neb. 1889
John E. Randall . . . . . Memphis, Tenn. 1887
Dr. John H. Rauch, Grand Pacific Hotel . . . . . Chicago, Ill. 1872
Dr. William C. Ravenel . . . . . Charleston, S. C. 1890
Dr. Joseph H. Raymond, 173 Joralemon St. . . . . Brooklyn, N. Y. 1882
Dr. J. W. Redden . . . . . Topeka, Kan. 1887
Hon. Harrison Reed . . . . . Jacksonville, Fla. 1888
Dr. R. Harvey Reed . . . . . Mansfield, Ohio. 1884
Dr. J. T. Reeve . . . . . Appleton, Wis. 1876
Dr. James E. Reeves . . . . . Chattanooga, Tenn. 1872
Dr. Edward A. Reiley, 312 Baldwin St. . . . . Elmira, N. Y. 1890
Dr. Peter Charles Remondino, corner F and Sixth Sts. . . . . San Diego, Cal. 1890
Dr. B. O. Reynolds . . . . . Lake Geneva, Wis. 1884
Dr. Ephraim M. Reynolds . . . . . Centreville, Iowa. 1890
Dr. Albert R. Rice . . . . . Springfield, Mass. 1884
Mrs. E. H. Richards, Institute Technology . . . . Boston, Mass. 1888
C. L. Richards . . . . . Davenport, Iowa. 1887
Edgar Richards, Treasury Department . . . . Washington, D. C. 1889
Dr. C. T. Richardson . . . . . Charleston, W. Va. 1881
Dr. Dwight A. Richardson . . . . . Shelton, Conn. 1885
Maj. Henry B. Richardson, C. E. . . . . New Orleans, La. 1880
Dr. W. L. Richardson, 225 Commonwealth Ave. . . . Boston, Mass. 1875
Dr. William C. Rives, Jr., 43 E. 31st St. . . . . New York City. 1885
Dr. John B. Roberts, 1627 Walnut St. . . . . Philadelphia, Pa. 1886
James S. Robinson, ... Memphis, Tenn. 1887
Prof. Franklin C. Robinson . . . . . Brunswick, Me. 1889
Dr. John B. Robinson . . . . . Omaha, Neb. 1889
Dr. Francis J. Rogers . . . . . Stamford, Conn. 1889
Dr. George H. Rohé . . . . . Baltimore, Md. 1880
Dr. Henry W. Rose . . . . . Westerly, R. I. 1886
Dr. Ross B. Rowe . . . . . Reading, Pa. 1888
J. B. Rozier . . . . . Memphis, Tenn. 1887
Dr. Thomas P. Russell . . . . . Oshkosh, Wis. 1888
Dr. R. Rutherford . . . . . Houston, Tex. 1879
D. E. Salmon, D. V. M. . . . . Washington, D. C. 1883
Dr. Lucien F. Salomon . . . . . New Orleans, La. 1879
Prof. J. Leonard Sanford . . . . . New Haven, Conn. 1885
Prof. D. A. Sargent . . . . . Cambridge, Mass. 1883
Dr. Wilbur T. Sarles . . . . . Sparta, Wis. 1888
Dr. Adolf F. Saurehering . . . . . Mayville, Wis. 1888
Dr. D. D. Saunders . . . . . Memphis, Tenn. 1879
Dr. N. J. Sawyier . . . . . Frankfort, Ky. 1879
Dr. John H. Sears . . . . . Waco, Tex. 1887
Dr. Nicholas Senn . . . . . Milwaukee, Wis. 1888
Dr. Charles H. Shepard, 81 Columbia Heights . . Brooklyn, N. Y. 1889

Dr. J. L. Shepard . . . . . Sheboygan Falls, Wis. 1888
Dr. George R. Shepherd . . . . . Hartford, Conn. 1886
Dr. George W. Sheppard . . . . . Atlantic City, N. J. 1889
Dr. B. Franklin Sherman . . . . . Ogdensburg, N. Y. 1887
Dr. John J. Sherman . . . . . Marinette, Wis. 1888
Dr. William H. Shipps . . . . . Bordentown, N. J. 1889
Dr. John C. Shrader . . . . . Iowa City, Iowa. 1890
Dr. John D. Shull . . . . . Hightstown, N. J. 1888
Dr. F. L. Simm . . . . . Memphis, Tenn. 1885
Dr. T. Grange Simons . . . . . Charleston, S. C. 1881
Dr. James Simpson . . . . . San Francisco, Cal. 1886
Dr. Maxwell G. Simpson . . . . . Jersey City, N. J. 1889
Dr. C. M. Sitman . . . . . Greensburg, La. 1878
Dr. Charles Smart, U. S. A. . . . . Washington, D. C. 1882
Samuel M. Smedley, C. E. . . . . Philadelphia, Pa. 1874
Dr. Charles D. Smith . . . . . Portland, Me. 1885
Dr. David S. Smith, 1255 Michigan Ave. . . . . Chicago, Ill. 1880
Dr. Hugh M. Smith, 78 Orange St. . . . . Brooklyn, N. Y. 1889
Dr. Joel W. Smith . . . . . Charles City, Ia. 1888
Dr. Joseph R. Smith, U. S. A. . . . . Los Angeles, Cal. 1874
Roland H. Smith, M. E. . . . . Pittsburgh, Pa. 1887
Rev. Samuel G. Smith, D. D. . . . . St. Paul, Minn. 1889
Dr. Stephen Smith, 574 Madison Ave. . . . . New York City. 1872
Dr. Theobald Smith . . . . . Washington, D. C. 1888
Gen. W. J. Smith . . . . . Memphis, Tenn. 1878
Dr. William M. Smith . . . . . Rosebank, N. Y. 1880
Dr. Whitmore Sniverly . . . . . Pittsburgh, Pa. 1873
Dr. Andrew B. Somers . . . . . Omaha, Neb. 1888
Dr. S. B. Sperry . . . . . Delafield, Wis. 1888
Dr. Joseph Spiegelhalter, 2166 Lafayette Ave. . . . St. Louis, Mo. 1880
Prof. J. M. Stalker, D. V. S. . . . . Ames, Iowa. 1890
Dr. Byron Stanton . . . . . Cincinnati, Ohio. 1889
Dr. Franklin Staples . . . . . Winona, Minn. 1885
Dr. Ralph E. Starkweather . . . . . Springfield, Ill. 1879
Dr. Lewis H. Steiner . . . . . Baltimore, Md. 1872
Dr. George M. Sternberg, U. S. A. . . . . San Francisco, Cal. 1874
Dr. James A. Steuart . . . . . Baltimore, Md. 1874
Dr. Eugene F. Storke . . . . . Milwaukee, Wis. 1888
Dr. Charles Sutherland, Surgeon-General U. S. A., Washington, D. C. 1889
Dr. W. R. D. Sutherland . . . . . Winnipeg, Manitoba. 1886
Dr. Frank Swallow . . . . . Valley Falls, Kan. 1889
Dr. R. M. Swearingen . . . . . Austin, Tex. 1880
Dr. Dr. R. P. Talley . . . . . Belton, Tex. 1880
Albert B. Tavel, Esq. . . . . Nashville, Tenn. 1879
Dr. J. P. Thomas . . . . . Pembroke, Ky. 1889
M. Louise Thomas, 680 Lexington Ave. . . . . New York City. 1888
Dr. Theodore G. Thomas . . . . . New York City. 1888
Dr. Pinckney Thompson . . . . . Henderson, Ky. 1879

Dr. Sidney Thompson . . . . . Kerrville, Tenn. 1887
Dr. G. B. Thornton . . . . . Memphis, Tenn. 1879
Dr. A. D. R. Thrane . . . . . Eau Claire, Wis. 1889
J. L. Tobias, Chairman Board of Health . . . . Charleston, S. C. 1890
Dr. Joseph M. Toner . . . . . Washington, D. C. 1872
Dr. Edwin C. Town, 309 N. 37th St. . . . . Philadelphia, Pa. 1888
Dr. Smith Townshend . . . . . Washington, D. C. 1879
Dr. Roger S. Tracy, 67 W. 37th St. . . . . New York City. 1889
Dr. George E. Trescott . . . . . Greenville, S. C. 1878
Dr. Thomas J. Turner, U. S. N. . . . . Coldwater, Mich. 1877
Dr. Gerrard G. Tyrrell . . . . . Sacramento, Cal. 1885
Dr. W. C. Van Bibber . . . . . Baltimore, Md. 1875
Dr. Joshua M. Van Cott, Jr., 188 Henry St. . . . Brooklyn, N. Y. 1889
Dr. J. H. Van Deman . . . . . Chattanooga, Tenn. 1873
Dr. F. P. Vandenbergh . . . . . Buffalo, N. Y. 1888
Dr. E. V. Van Norman . . . . . San Diego, Cal. 1882
Dr. B. A. Vaughan . . . . . Columbus, Miss. 1882
Dr. E. E. Vaughan . . . . . Cambridge, Mass. 1887
Dr. Victor C. Vaughan . . . . . Ann Arbor, Mich. 1883
Prof. Frank Preston Venable . . . . . Chapel Hill, N. C. 1890
D. W. W. Vinnedge . . . . . Lafayette, Ind. 1882
Dr. John H. Vivian . . . . . Mineral Point, Wis. 1888
Dr. E. P. Vollum, U. S. A., Broadway . . . . New York City. 1889
Dr. Karl Von Ruck . . . . . Ashveville, N. C. 1890
Dr. F. L. Von Suessmilch . . . . . Delevan, Wis. 1889
Dr. Henry P. Walcott . . . . . Cambridge, Mass. 1880
Dr. Jerome Walker, 8 Seventh Ave. . . . . Brooklyn, N. Y. 1889
Dr. John P. Wall . . . . . Tampa, Fla. 1875
Dr. D. A. Wallace . . . . . Terrell, Tex. 1889
Dr. David L. Wallace . . . . . Newark, N. J. 1885
Shippen Wallace, Ph. D. . . . . Burlington, N. J. 1885
Dr. Ralph Walsh . . . . . Washington, D. C. 1885
L. B. Ward, C. E. . . . . Jersey City, N. J. 1885
Dr. Horace Wardner . . . . . La Porte, Ind. 1877
Col. George E. Waring, C. E. . . . . Newport, R. I. 1875
Dr. Irving A. Watson . . . . . Concord, N. H. 1881
Dr. J. Madison Watson . . . . . Elizabeth, N. J. 1882
Dr. R. D. Webb . . . . . Birmingham, Ala. 1878
Albert L. Webster, C. E., 107 Drexel Building . . New York City. 1885
Dr. John O. Webster . . . . . Augusta, Me. 1889
Dr. Warren Webster, U. S. A., P. O. Box 850 . . Baltimore, Md. 1873
Dr. Henry M. Wells, U. S. N. . . . . Washington, D. C. 1889
Dr. Joseph M. Wells . . . . . Camden, N. J. 1887
Dr. H. P. Wenzel . . . . . Milwaukee, Wis. 1888
Hon. James A. Weston . . . . . Manchester, N. H. 1890
Dr. William C. Wey . . . . . Elmira, N. Y. 1872
Alfred T. White, 40 Remsen St. . . . . Brooklyn, N. Y. 1889
William A. White, 158 Columbia Heights . . . . Brooklyn, N. Y. 1889

Dr. C. P. Wilkinson . . . . . New Orleans, La. 1889
Dr. J. Louis Williamson . . . . . Milwaukee, Wis. 1888
Dr. G. H. Wilson, 50 Colony St. . . . . Meriden, Conn. 1890
Dr. A. E. Winchell . . . . . New Haven, Conn. 1886
Dr. Uranus Owen Brackett Wingate, Commissioner of Health, 204 Biddle St. . . . . Milwaukee, Wis. 1890
Elisha Winter, 179 Quincy St. . . . . Brooklyn, N. Y. 1879
Dr. Simeon P. Wise . . . . . Millersburg, Ohio. 1886
Dr. G. F. Witter . . . . . Grand Rapids, Mich. 1877
Prof. Edward S. Wood . . . . . Boston, Mass. 1876
Dr. Thomas F. Wood . . . . . Wilmington, N. C. 1878
Dr. A. A. Woodhull, U. S. A. . . . . Somerville, N. J. 1874
Dr. Nathaniel Eugene Wordin, 174 Fairfield Ave. Bridgeport, Conn. 1890
William E. Worthen, C. E., 63 Bleeker St. . . . New York City. 1872
Dr. A. R. Wright . . . . . Buffalo, N. Y. 1881
Dr. Franklin W. Wright . . . . . New Haven, Conn. 1889
Dr. John Wright . . . . . Sardis, Miss. 1879
Dr. Benjamin Franklin Wyman . . . . . Aiken, S. C. 1890
Dr. Walter Wyman, Super. Surgeon-General U. S. M. H. S. . . . . Washington, D. C. 1884
Dr. A. G. Young, ... Augusta, Me. 1885
Dr. Francis J. Young . . . . . Bridgeport, Conn. 1887
Andrew Young . . . . . Chicago, Ill. 1884
John Preston Young . . . . . Memphis, Tenn. 1888

ASSOCIATE MEMBERS.

William Gravel, 788 Broadway . . . . . New York. 1890
Alexander L. Patrick . . . . . Detroit, Mich. 1889
Rev. Joseph Wild, D. D. . . . . Toronto, Ont. 1886

HONORARY MEMBERS.

Ex-President Grover Cleveland . . . . . New York City. 1885
Dr. J. B. Russell, LL. D. . . . . Glasgow, Scotland. 1886
Mrs. Elizabeth Thompson . . . . . New York City. 1887

LIFE MEMBER.

Henry Lomb . . . . . Rochester, N. Y. 1884

LIST OF MEMBERS ELECTED AT THE NINETEENTH ANNUAL MEETING,

HELD AT

KANSAS CITY, MO., OCTOBER 20–23, 1891.

ACTIVE.

Dr. C. A. ABERNATHY, County Health Officer . . . . . Pulaski, Tenn.
Dr. EDWARD THOMAS ABRAMS . . . . . Dollar Bay, Mich.
Dr. CHARLES W. ADAMS, Professor of Diseases of Women, University Medical College, 1233 Grand Ave. . . . . Kansas City, Mo.
EDWIN R. ALLEN, V. S., U. S. Veterinary Inspector . . . Kansas City, Mo.
Dr. JOHN M. ALLEN . . . . . Liberty, Mo.
Dr. NORMAN ALLEN, Health Officer . . . . . Toronto, Ont.
Dr. JAMES F. AYDELOTTE, County Health Officer . . . Decaturville, Tenn.
Dr. JAMES WOODS BABCOCK, Supt. of Lunatic Asylum, of South Carolina . . . . . Columbia, S. C.
Dr. SAMUEL WESTRAY BATTLE, P. A. Surgeon U. S. Navy, member State Board of Health . . . . . Asheville, N. C.
Dr. C. W. BEAUMONT, City Health Officer . . . . . Clarksville, Tenn.
Dr. JOHN P. BLANKENSHIP, County Health Officer . . . . Maryville, Tenn.
MARY A. BOLAND, Supt. Dept. of Cooking, Nurses' Training-School, Johns Hopkins Hospital . . . . . Baltimore, Md.
Dr. MOSES H. BONNER, Health Officer of Davidson County . Nashville, Tenn.
Dr. ARTHUR BOSANKO . . . . . Leadville, Col.
Dr. SETH D. BOWKER, U. S. Pension Examiner . . . . . Kansas City, Mo.
Dr. S. B. BOYD, City Health Officer . . . . . Knoxville, Tenn.
JOSEPH H. BRADY, Chief-Engineer Board of Education, 1331 Walnut St. . . . . Kansas City, Mo.
Dr. J. CURRY BRUBAKER, 1801½ Independence St. . . . . Kansas City, Mo.
T. B. BULLENE, Merchant, Ex-Mayor . . . . . Kansas City, Mo.
Dr. RALPH BUTTERFIELD, 589 Grand Ave. . . . . Kansas City, Mo.
Dr. JOHN H. CALLENDER, Supt. State Asylum for the Insane Nashville, Tenn.
Dr. MICHAEL CAMPBELL, Supt. State Asylum for the Insane . Knoxville, Tenn.
Dr. JESUS CHICO, Delegate from the State of Guanajuato, 2 Estrella St. . . . . Guanajuato City, Guanajuato, Mex.
Dr. J. B. COWAN, President Board of Health . . . . . Tullahoma, Tenn.

ALGERNON S. CURREY, Esq., Voluntary Observer for State Board of Health . . . . . Trenton, Tenn.
Dr. WILLIAM P. CUTLER, General Secretary Missouri Institute of Homœopathy, 1227 Michigan St. . . . . Kansas City, Mo.
J. J. DAVENPORT, Esq., Ex-Mayor, 309 Massachusetts Building . . . . . Kanaas City, Mo.
Dr. FREDERICK FRANCIS D'AVIGNON . . . . . Leadville, Col.
Dr. THOMAS SPENCER DAWES, State Commissioner of Health, 245 Main St. . . . . Saugerties, N. Y.
Dr. JOHN H. DEARBORN, Member Board of Health, 265 Cabot St. . . . . Beverly, Mass.
Prof. J. E. DENTON, Prof. Experimental Mechanics, Stevens Institute of Technology . . . . . Hoboken, N. J.
Dr. WILLIAM B. DEWEES, President Golden Belt Medical Society of Kansas, 542 South Santa Fé Ave. . . . . Salina, Kan.
Dr. THOMAS J. DILLS, Member State Board of Health, 40 West Berry St. . . . . Fort Wayne, Ind.
Dr. FLORENCE O. DONOHOE, Com. State Board of Health, . Syracuse, N. Y.
Dr. JOHN P. DOUGLAS, Supt. State Asylum for the Insane . . Bolivar, Tenn.
ERNEST S. DUNDAS, V. S., U. S. Veterinary Inspector, 111 W. 14th St. . . . . Kansas City, Mo.
Dr. GEORGE L. EYSTER, Commissioner of Health, 1109 Second Ave. . . . . Rock Island, Ill.
Dr. S. B. FOWLER, County Health Officer . . . . . Gainesboro, Tenn.
Hon. DAVID R. FRANCIS, Governor of Missouri . . . . Jefferson City, Mo.
Dr. CLARKE GAPEN, L. L. B., Commissioner of Health, 131 S. 25th St. . . . . Omaha, Neb.
Dr. JOSEPH L. GASTON, President Board of Health . . . Chattanooga, Tenn.
Dr. SAMUEL H. GAULT, County Health Officer . . . . Rogersville, Tenn.
Dr. A. GAVINO, Professor of Bacteriology, Medical School City of Mexico, Ratas No. 4 . . . . . Mexico, Mex.
ROBERTO GAYOL, C. E., City Engineer, Engineer to the Mexican National Board of Health . . . . . Mexico, Mex.
Dr. GRANDISON A. GOBEN, Member State Board of Health. . Kirkesville, Mo.
Mr. GRAHAM, Chairman Local Board of Health . . . . . Toronto, Ont.
Dr. MASON W. GRAY, Member State Board of Health, 9 Saginaw St., N. . . . . Pontiac, Mich.
SAMUEL M. GRAY, C. E., Member State Board of Health, 16 Larch St. . . . . Providence, R. I.
Dr. BENJAMIN M. GRIFFITH, Member State Board of Health . Springfield, Ill.
Dr. JEFFERSON D. GRIFFITH, Prof. of Surg., Kansas City Med. Coll., President State Board of Health . . . . Kansas City, Mo.
HENRY A. GUINZBURG, ... St. Louis, Mo.
Dr. MANUEL GUTIERREZ, Delegate from the State of Queretaro, 13 Aduana Vieja . . . . . Mexico.
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